



Issue 4—December 19, 1997

***** IN THIS ISSUE *******Feature*****1997: Year of the Pentium® II Processor—1998: Year of New PC Platforms***

Intel President Craig Barrett provides our year-end review discussing the impact of the Pentium II processor in 1997 and perspectives on new types of PC platforms in 1998. Find all of the details in our related Focus article.

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Top Stories***AGP Done Right: Combine the Pentium II Processor with the Intel 440LX AGPset***

Intel's Director of Chip Set Engineering describes how AGP was designed to work with the Dual Independent Bus (DIB) architecture of the Pentium II processor to meet the growing user expectations of visual computing applications.

Intel's Application Launch Accelerator Technology Loads Software Faster

Intel's new software technology to be included in Windows* 98 dramatically decreases the time it takes for software applications to load from the hard disk drive by improving the performance of PC storage subsystems.

Design High-Quality Audio at Lower Cost with Audio Codec '97 Version 2.0

The recently released extensions to the AC '97 specification improve audio/modem integration enabling cost-effective, high-quality audio on your 1998 PC platforms.

A New Wakeup Call for the Instantly Available PC—3.3 Vaux ECR

New updates to the PCI Power Management Interface Specification provide the industry's first standard approach to supporting power-managed PCI device wakeup for easy implementation of the Instantly Available PC's "Off-Yet Communicating" capabilities.

The Best Way to Implement 1394 Technology—Q & A with Intel's 1394 Experts

Intel's program manager and technical marketing engineer answer your top questions on 1394 technology implementation including P1394a protocol enhancements.

Platform News and Information

***** Check out our Platforms, Technologies and Events pages *****

Every month we cover the latest developments in platform initiatives and technologies. Our "Platforms" pages provide news on the latest trends and initiatives for the business, home, mobile, server and workstation platforms. Our "Technologies" pages give you quick and detailed information on the industry status of specific platform technologies, from the emergence of the Accelerated Graphics Port (AGP) to the latest advances in Intel microprocessors, memory, Audio, USB, 1394, DVD, Power Management, and PC 98. Our "Industry Events" page keeps you up to date on upcoming industry gatherings targeted at the platform and peripheral developer.

Technology News

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- **3.3Vaux ECR adds Standard Wakeup Capability** to Instantly Available PC
(<http://developer.intel.com/design/power/pcipower.htm>)
- Get the **latest updates to PC 98 System Design Guide**
(<http://developer.intel.com/solutions/tech/pc98.htm>)
- Instantly Available PC **Design Guide Updated**
(<http://developer.intel.com/design/power/pcpower.htm>)
- **Virtual Interface Architecture** spec 1.0 completed and available for download
(http://www.viarch.org/html/Spec/vi_specification_version_10.htm)
- New **Wired for Management FAQ** Available
(<http://developer.intel.com/ial/dmi/support/faqs.htm>)
- **1394 OHCI Spec Released** - Open Host Controller Interface - Revision 1.0
(<ftp://www.austin.ibm.com/pub/chrptech/1394ohci/>)
- **Mobile Power Guidelines Final Version 1.0** Released to Industry
(<http://developer.intel.com/design/mobile/intelpower/>)
- **Lean Client & Network Server** Plans Announced by Intel
(<http://www.intel.com/pressroom/archive/releases/LC120397.HTM>)
- Download the **New DVD-Video Playback Primer** White Paper
(<http://developer.intel.com/solutions/tech/dvd.htm>)
- **New I₂O[®] Technology White Paper** Available by Aberdeen Group
(<http://www.intel.com/procs/servers/press/aberdeen/body.htm>)
- Intel publishes **SFX Power Supply Design Guide** for small Form Factors
(<http://www.teleport.com/~atx/spec/index.htm>)
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On behalf of all of us at Platform Solutions, welcome to the future of the PC platform!

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Feature:

1997: The Year of the Pentium® II Processor—1998: The Year of New PC Platforms

*by Craig Barrett
President and Chief Operating Officer
Intel Corporation*

Looking back on 1997, the computer industry took a great leap forward in computing power and capability. It was a banner year that started with the introduction of Intel's MMX™ technology, bringing enhanced multimedia and communications capability to PC users, and ended with the dawn of a new generation, the Pentium II processor.

1997 also brought another significant change to the computing landscape – the PC continued to evolve from its “one-size-fits-all” paradigm into platforms targeted at specific uses and price points. The burgeoning Internet is driving demand for high volume, standards based servers delivering scalable performance. The shift to **visual computing** (<http://developer.intel.com/solutions/archive/issue1/focus.htm>) is driving demand for high performance graphical workstations for content creation and volume performance-oriented desktop computers with powerful processors and graphics subsystems. Business computing is witnessing the emergence of smaller form factors like the Network PC (Net PC) which fully utilizes Intel's Wired for Management baseline to lower the total cost of ownership.

Visual computing is also driving demand for home PC's which today are capable of handling new applications categories such as digital imaging, POTS video conferencing and video editing. Rich online content coupled with DVD format media is creating new family entertainment categories. So not only is the industry delivering competitive price points below \$1000 for many basic systems, developers are continuing to use the performance of the Intel Architecture for the most demanding home and business computing platforms.

Although the packaging and peripherals of these multiple system types is quite different, as we move into 1998 all will take advantage of a common computing core – the Pentium II processor with its Dual Independent Bus (DIB) architecture. Intel is planning a variety of Pentium II processors with various cache and peripheral configurations to meet a wide range of price/performance needs.

I see Intel continuing to play a critical role in the industry by working on platform technologies that will deliver the full capability of these new Pentium II processors, resulting in balanced platform designs. Examples include AGP-4X, host-based DVD, digital audio, broadcast standards, USB/1394, and PC Cameras for both still and video capture and editing. Platform level specifications will also take advantage of these new technologies and continue to evolve. Expect to see Set-Top Computers (STC's) for the family room, and lean client and network servers for the enterprise.

I invite you to stay in touch with these exciting platform technology developments by regularly visiting the Platform Solutions newsletter. You should also plan on attending the next **Intel Developer Forum** (<http://developer.intel.com/design/idf>) in February, which is designed to provide the latest implementation details from our lead platform architects. At Intel we are preparing for another exciting year that promises even more industry opportunity than 1997.

About the Author

Craig Barrett is the President and Chief Operating Officer of Intel Corporation. He is responsible for Intel's day to day operations and is a member of the board of directors.

For More Information

For all of the details on the new PC platform types and their enabling technologies, please refer to the full-length **Focus article** in this month's issue of Platform Solutions.

(<http://developer.intel.com/solutions/focus.htm>)

To get the latest news around the technologies driving next generation platforms, visit the platform or technology page of your choice in **Platform Solutions**. (<http://developer.intel.com/solutions>)

Focus:

Transformation of the PC Platform

The End of the PC as We Know It

In the months ahead, we will look back on 1997 as the “year of transformation of the PC platform.” This is the year when the traditional PC broke out of its “one-size-fits-all” paradigm to encompass a wide range of specialized usage models.

As we enter 1998, the Intel Architecture PC has actually become a diverse set of platform types, each targeted for optimized performance, ease-of-use and enhanced user experiences in a specific computing role. This transformation was triggered by a quantum leap in computing power and capability in 1997. The year began with the introduction of Intel's MMX™ technology, which brings enhanced multimedia and communications capability to every PC platform. The spring of 1997 marked the introduction of the Pentium® II processor, and its rapid deployment into the mainstream of PC applications. The Pentium II processor, with its Dual Independent Bus (DIB) architecture and Accelerated Graphics Port (AGP) platform technology, brings awesome 3D, digital imaging, and video-based **visual computing capabilities** (<http://developer.intel.com/solutions/archive/issue1/focus.htm>) to PCs at price points which are affordable for many users. The year is ending with the dawn of a new generation of differentiated, application-specific PC platforms which are influencing our industry and also driving some internal changes at Intel.

This ongoing process of platform diversification and the creation of new usage models creates fertile ground for continuous innovation. The familiar office business desktop PC is evolving into a high performance workstation, as well as into smaller form factor products like the Network PC (Net PC) that utilizes Intel's Wired for Management baseline to help reduce total cost of ownership. Concurrent advances in server and mobile platforms are creating a full spectrum of PC platforms for the modern corporation. The home PC, which started its life as a multimedia, business desktop PC brought home to perform office-related tasks, has evolved into multiple different system types, this time optimized for different rooms in the home. Today's PC platform family stands in stark contrast with the traditional trio of platform types which existed at the beginning of 1997.

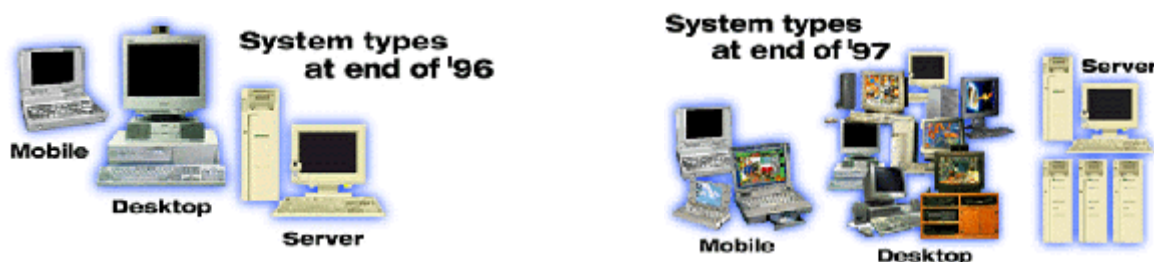


Figure 1 - end'96 vs. end'97 platform choices

New PC Platforms Built on a Common Core

Before we look at the variety of new PC platform types, let's understand the essential technologies that they have in common. A look inside any of these different PCs reveals an Intel Architecture processor at their core. While the performance requirements will vary across the range of new applications, consistency of processor architecture provides numerous benefits, including the ability to support a common operating system and human interface across all platforms. This facilitates learning and training and makes it relatively easy to migrate between different platform types. In addition, common applications software designed for scalability shows improved performance on more powerful platforms, such as improved texture mapping in real-time 3D graphics and improved audio fidelity for enhanced user experiences.

For optimal performance of each platform, it is necessary to balance the design around the capabilities of the specific **Intel Architecture processor** (<http://developer.intel.com/solutions/tech/micro.htm>) and the intended application. High-performance processors will utilize high-performance chip sets and memory subsystems, while lower performance processors can use commodity components. Common hardware instrumentation across all platforms also provides a consistent manageability solution. Some platforms will have a single PCI bus for internal I/O expansion, while others will also include a high-speed **AGP** (<http://developer.intel.com/solutions/tech/aggp.htm>) bus, or even additional PCI bus segments. External I/O expansion will support new digital peripherals via **Universal Serial Bus (USB)** (<http://developer.intel.com/solutions/tech/usb.htm>) and **IEEE 1394** (<http://developer.intel.com/solutions/tech/1394.htm>) for high-speed consumer electronics peripherals. The bottom line is that a common architectural core exists at the heart of each PC platform type—the Pentium II processor. The difference between the types of PCs is the level of processing power (with balanced platform technologies), the platform packaging, the applications software and peripheral devices used by each.

Top to Bottom Platforms for the Office

As today's business environment grows in complexity, it is essential to make all desktop PCs, servers and notebooks easier to manage. Intel is driving, through its **Wired for Management (WfM) initiative** (<http://developer.intel.com/solutions/tech/wfm.htm>), a broad-based industry effort to integrate all of the pieces of the enterprise architecture in a way that provides greater control and manageability, so that the total cost of ownership for the computing infrastructure can be reduced. A key component of the WfM initiative is the WfM Baseline specification which establishes a set of management interfaces designed to enable advanced system administration features, including remote configuration and repair, the ability to "wake up" systems for off-hours maintenance and to give IT organizations greater centralized management capabilities, while retaining existing LAN infrastructures. Design recommendations for desktop, server, and mobile platforms are made in the WfM Baseline specification.

One of the first complete instantiations of a fully capable WfM baseline client PC was launched in 1997—the **Network PC (Net PC)** (<http://developer.intel.com/tech/netpc.htm>). Designed specifically for the user who does not need the plug-and-play flexibility of a traditional PC, the Net PC can realize some additional cost savings by its smaller, "sealed-case" implementation. In operation, access to the user's desktop features and to software applications is controlled by the system administrator. Hard disk drives give users the choice of running their Windows*-based business software and storing data locally or on servers (central file storage is recommended to facilitate file archiving and employee movement). No new software is required since, at the application level, the Net PC is identical to a traditional PC so these systems are rapid to deploy. The Net PC is a new category of business client PCs designed from the ground up to be centrally managed, while simultaneously delivering the power and versatility of a traditional desktop computer.

The traditional business desktop PC has moved to a higher capability level thanks to the Pentium II processor and other base platform enhancements such as AGP. Delivering **advanced workstation performance** (<http://developer.intel.com/solutions/platfms/workstat.htm>) while simultaneously providing all the compatibility and interoperability advantages of the Intel Architecture, means an increase in visual computing applications such as digital content creation for Web applications, video editing, video conferencing, streaming video with high quality audio and 3D data visualization tools. The range of

applications that are served by the business desktop continues to expand. The flexibility of this plug-and-play desktop, where custom I/O devices may be added, allows for a uniform base system to be deployed across a company and configured for the application. This commonality of base hardware and manageability architecture reduces support costs and spares inventory.

Intel Architecture-based **server platforms** (<http://developer.intel.com/solutions/platfms/server.htm>) evolved in 1997 to deliver the performance, scalability and reliability needed to meet mission critical computing requirements. Intel Pentium II and Pentium® Pro processor based servers with **I₂O® technology** (<http://developer.intel.com/solutions/tech/i20.htm>), delivering "mainframe-class" performance with ample headroom for future growth, were announced by the server industry in October. The **Virtual Interface (VI) architecture**, (<http://developer.intel.com/solutions/tech/via.htm>) was also announced in 1997 with support from many industry server leaders as an open specification that will enable a new class of scalable cluster products offering high performance, low total cost of ownership and broad applicability. Many companies are now delivering "Standard High Volume Servers" to support the growing needs of the internet and intranets within corporations. Increased competition around a standard core, along with open specifications that drive performance, scalability, and reliability will mean increased capability at lower prices.

1998 will bring opportunities across the whole business computing range. At the client entry level specifically, there is space below the current Net PC for a "terminal replacement" product. Intel is developing design guidelines for a **lean client and optimized network server** (<http://www.intel.com/pressroom/archive/releases/LC120397.HTM>) that will support a variety of operating environments. This will enable OEMs to deliver an integrated, end-to-end solution with a common computing foundation and management technologies based on the Intel Architecture. There will be a continued move to 100 Mb networks and this has design implications in both client and server implementations. Improvements in the Wired for Management baseline for Servers, mobile platforms, as well as additional remote wakeup capabilities for desktop clients are already in the works.

Growing Mobile Power for the Road

The power of the Intel Architecture based computing platform for work outside of the office also took a big leap in capability in 1997. Intel adapted its Pentium processors with MMX technology to move mobile PC platforms to new levels of performance, extended battery life and innovative form factors. Intel's new 200- and 233MHz mobile Pentium processors with MMX technology were the first processors from Intel's 0.25 micron manufacturing process, consuming up to 50 percent less power than previous generation mobile processors. This allows a laptop computer to deliver a level of business performance that was available only from a desktop business computer in early 1997. Intel also delivers these high-performance low-power processors in a new building block level with its Mobile Module. The innovative Mobile Module integrates a Pentium processor with an Intel 430TX PCIset system controller and a 512Kbyte Level 2 cache. The Mobile Module is a high-integration solution for quick time to market designs. By allowing the chips to be mounted flush with the motherboard, the Mobile Module allows full PC functionality to be incorporated into a variety of compact new designs. In addition, the Mobile Module enables fast and cost-effective upgrades to future Intel processors and chip sets. We will see many new mobile computers in various form factors in 1998 based on these new processors and mobile modules.

A new category of notebook computer was introduced in 1997. Weighing less than 2 pounds and the size of a VHS cassette, the new mini-notebook is a full-function, MMX technology enabled, Windows® 95 computer. This mini-notebook can be carried everywhere, but includes special software and an IR link to keep it synchronized with the office PC.

Intel will continue to drive the evolution of the mobile platform in 1998 through its **Mobile Power Initiative** (<http://developer.intel.com/solutions/tech/mpi.htm>), an industry wide program for mobile PC manufacturers, component suppliers and software vendors. This comprehensive initiative addresses the mobile PC industry's power consumption challenges in three major areas including System Hardware, System Software, and Application Software, in order to deliver high-end mobile features in ever smaller form factors.

New "PCs" Throughout the Home

The performance of home PCs based on the Pentium II processor is defining profound new usage models for creativity and family entertainment.

The **Creativity PC** (<http://developer.intel.com/solutions/tech/creapc.htm>) takes advantage of the power of the Pentium II processor for digital imaging, video editing and audio/music creation. The PC is the perfect vehicle for enhancing, storing and sharing still images from a variety of sources, including portable PC cameras and conventional scanners. Images can also be created using a variety of easy-to-use 3D rendering packages. Users can merge and edit this content to create richness, variety and information value to children's homework assignments, family albums, custom greeting cards, photo restoration and e-mail. The recent introduction of affordable photo-realistic printers has unleashed a great deal of excitement amongst users and developers. The creativity PC can also capture and process video data in real time. Once inside the PC, the digital information can be edited using similar techniques to those used in Hollywood. For the first time, that six hours of vacation video footage can be edited into a 30-minute program that friends and relatives may actually enjoy watching! The ability of the PC to manipulate other rich data types, such as music, adds additional creative energy to the home. The difference in sound quality from a PC over the past year is absolutely remarkable—the PC can now digitally process 3D positional sound with two speakers or decode full AC3, studio quality, Dolby* approved sound to five speakers. You get the most fun, however, when combining all of these applications to create original works such as a school year book, a wedding or a birth. We can all be TV producers now!

In 1997 the PC also moved into the family room becoming more of a family entertainment device. In its external design, the PC Theater is quite different than a traditional PC. It is designed much more like an appliance which is always on and never requires users to open the box. Like other home appliances, ease-of-use and ease-of-ownership are key parameters for its design. The internal CD-ROM drive is replaced by a DVD-ROM providing extremely high quality motion video and studio quality audio with the PC Theater's large screen display for family entertainment. In addition to playing commercial DVD movies like a consumer electronics DVD player, the PC Theater adds interactivity and depth of integrated control which is not possible with traditional consumer electronics devices. All expansion is accomplished through the use of external connections. The rear panel of the PC Theater looks more like a stereo tuner/amplifier than a traditional PC. Users can find connections for a satellite dish, a sound system with two to five speakers, and a camera that enables video conferencing over a standard telephone line. The telephone line is important, because it provides an Internet connection, allowing InterCast™ enhancements to regular broadcasts, in addition to Web browsing in the family room.

1998 promises to be another very active year for the home PC. A number of compelling applications were released for the home PC during 1997 which focused more on "home" than "PC." Home automation and computer integrated telephony (CTI) applications promise to make our lives easier. Many consumers are considering additional systems for their children—should these be standalone PCs or should they be networked to existing home PCs? Intel is also working on a new class of family room computers called the Set-Top Computer. Along with a number of other computer and consumer electronics companies, Intel recently submitted a proposal to the OpenCable process, whereby the cable industry is seeking input as to the best technical architecture for its next generation digital Set-Top computers. These Set-Tops would act as digital receivers for television and Internet services to be delivered over cable television systems to TVs, PCs and other home devices. Intel is strongly supporting OpenCable's philosophy of an open, horizontal architecture model similar to that which helped make the PC industry successful. Intel recently demonstrated this new category's viability at the Western Cable Show by demonstrating a Pentium processor-based Set-Top Computer running the NCI TV Navigator software.

Unique Platforms in New Places

PC platforms are now beginning to appear in non-traditional places, one of the most exciting of which is the automobile. The combination of Intel Architecture PC platform technology with CTI technology and voice recognition software allows the benefits of PC computing to extend to the hundreds of hours each year that many of us spend driving. Intel's **Connected Car PC technology** (<http://developer.intel.com/technology/carpc/>) can help drivers navigate, communicate with their office and even send e-mail. Car-pool passengers can scan articles or documents on the Internet or use productivity applications. Kids in the back seat can enjoy multiplayer games. Intel will demonstrate Connected Car PC technology at the Consumer Electronics Show in Las Vegas.

Intel Architecture PC platforms with the power of the Pentium II processor are also beginning to appear in arcade games. Intel's **Open Arcade Architecture** (<http://www.intel.com/pressroom/archive/releases/AI102397.HTM>) allows the traditional quality of arcade games to be enhanced with new features including Internet access and multiplayer interactivity. Developers can also write creative new games for arcades with the assurance that similar levels of quality and performance will be available to home PC users. USB connectivity allows home PCs to emulate the arcade versions with an array of input devices, ranging from foot pedals to force-feedback joysticks and steering wheels.



Figure 2 - Home of 2000
*Creating and Sharing Ideas and Memories, Informing, Educating, Socializing,
Entertaining, Communicating, Protecting, Coordinating*

What's Ahead in 1998

While the PC platform continues to differentiate itself along application lines as we enter 1998, Intel will continue to enhance the common computing core, the Pentium II processor. To meet the diverse needs of emerging PC platform application segments, Intel's product roadmap includes a variety of new Pentium II processors, ranging from lower-priced models with flexible cache and peripheral configurations to higher performing versions. Intel is also working closely with the industry to develop platform technologies which optimize and balance the full performance capabilities of the Pentium II processor. Examples include AGP-4X, host-based DVD, digital audio, broadcast standards, USB/1394 connectivity and PC cameras for both still and video capture and editing.

To better deliver these diverse new PC platforms and technologies in 1998, Intel Corporation recently reorganized its operations to reflect these market segmentation trends. Four new groups were created within Intel: the Consumer Products Group, the Business Platform Group, the Small Business and Networking Group and the Digital Imaging and Video Division. Intel's Computing Enhancement Group will continue to provide solutions for peripheral products and communications. This new organization makes Intel better able to serve the emerging variety of PC platforms during 1998. In a broader sense, it symbolizes the power of the trend toward platform segmentation which is now being felt throughout the industry.

To stay in touch with these trends in 1998, be sure to visit the **Platform Solutions newsletter** (<http://developer.intel.com/solutions>) online on a regular basis. In addition, don't miss the **Intel Developer Forum** (<http://developer.intel.com/design/idf>) in February. IDF provides the latest implementation details from Intel's leading platform architects. As we have seen, 1997 was a year of transformation for the PC platform and for the computer industry. Take a moment to reflect and catch your breath, because 1998 promises to be equally dynamic—and even more rewarding for the computer industry.

Top Stories:

AGP Done Right: Combine the Pentium® II Processor with the Intel 440LX AGPset

By Richard Malinowski

Director of Chip Set Engineering

Intel Corporation, Platform Components Division

As continuous technology innovation brings new levels of performance to desktop computing, the PC industry is delivering exciting leaps in user experience. Hardware and software vendors are working to make 3D graphics, DVD video and digital imaging available at every price point. These visual computing capabilities enable lifelike experiences on the PC, ranging from interactive Internet sessions and high impact business presentations to home video editing. At the core of these new **visual computing platforms** (<http://developer.intel.com/solutions/archive/issue1/focus.htm>) are the Pentium® II processor and the Accelerated Graphics Port (AGP) technology.

As market momentum builds for AGP, it should not be overlooked that the Pentium II processor's Dual Independent Bus (DIB) architecture and AGP are integral technologies. Socket 7 AGP implementations do not offer the performance headroom to keep up with visual computing needs and the accelerating pace of PC application delivery. By designing with the Intel 440 Family of AGPsets, PC developers can ensure the optimal balance and arbitration necessary to combine DIB and AGP architectures for 3D experiences and smooth video that surpass imagination.

Elements of a Balanced Visual Computing Platform

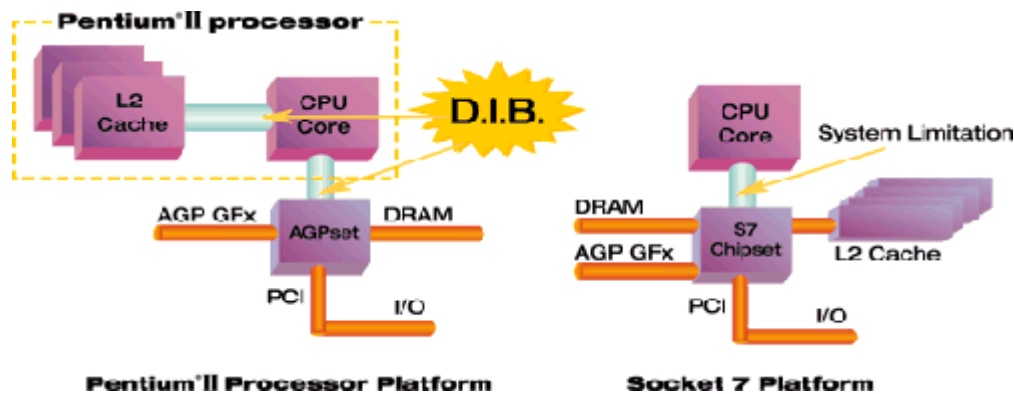
To deliver on the promise of AGP and meet user expectations, a computer platform must deliver high processor performance, scalable host-bus bandwidth, and a high bandwidth channel to graphics memory. Without these three platform elements, an AGP implementation will add cost without delivering compelling results.

Pentium II Processor Performance

As any graphics workstation designer will testify, powerful floating-point performance is essential for video and 3D geometry calculations. The core architecture of the Pentium II processor delivers Intel's highest floating-point performance today and will continue to scale with planned silicon geometry reductions. Additionally, the Pentium II processor's integrated L2 cache provides scalable cache performance—the faster the processor, the faster the L2 cache. Intel's Media Benchmark quantitatively demonstrates the **power of the Pentium II processor** (<http://developer.intel.com/procs/perf/PentiumII/imb3d.htm>) running algorithms found in multimedia applications. It incorporates audio and video playback, image processing, wave sample rate conversion and 3D geometry.

Scalable Host-Bus Bandwidth via DIB architecture

Once the platform has the processing capability to handle the needs of visual computing, it is essential to ensure an unabated path to system memory. The system must have a parallel architecture that enables the simultaneous execution of textures, commands and rendering by the graphics subsystem, while the processor performs geometry or 3D physics calculations. The Pentium II processor's DIB architecture frees the system bus for graphics transactions by dedicating a bus for L2 cache. A scalable path to L2 cache makes the system bus available for other main memory transfers and ensures that total system bandwidth scales as the processor's core frequency increases. By comparison, the Socket 7 architecture provides only a single bus to serve L2 cache, system memory and the demands of I/O. This results in processor and system bus bandwidth limitations which cap the performance of an AGP graphics implementation.



High Bandwidth Graphics Memory Channel

To complement the high performance of the Pentium II processor and the scalable host-bus bandwidth provided by the DIB architecture, it is critical to have a dedicated high-performance graphics subsystem to complete the visual computing platform. The Accelerated Graphics Port as implemented by the Intel 440LX AGPset creates a dedicated link to graphics that now provides 528 megabytes per second access to system memory for 3D texturing and video, complementing local graphics memory bandwidth. The AGP specification allows for various levels of implementation. Intel's 440 AGPset family delivers the highest level of AGP functionality by also including sideband addressing and pipelining to support sustained data bursts.

AGP Done Right—Today!

Intel has extensive development and new graphics capabilities. We have worked with leading software suppliers to simulate tomorrow's applications intensive visual computing environment and have designed solutions to meet the challenge. The resulting core logic building block—the Intel 440LX AGPset—includes the complex arbitration to enable PCI, AGP graphics and processor interleaved access to multiple open pages in system memory (referred to as Intel AGPset **Quad Port Acceleration** — <http://developer.intel.com/design/agpsets/440/index.htm#perform>). The 440LX ensures that all of the necessary elements for visual computing can coexist in a PC platform.

Platforms with the Pentium II processor and the Intel 440LX AGPset are becoming available at mainstream price points now serving the visual computing needs of all user segments, including home entertainment and creativity, small business and corporate PCs. To develop a system that can be marketed with AGP technology and meet the performance expectations of your customer base, be sure to start with the Pentium II processor and the Intel 440LX AGPset.

About the Author

Richard Malinowski is Director of Chip Set Engineering in Intel's Platform Components Division (PCD). He is responsible for the development of all of Intel's core logic chip set products for all Intel Architecture platforms.

For More Information

For more details on Intel's 440LX AGPset, now available in volume production quantities, please visit the **440LX AGPset web site**.

(<http://developer.intel.com/design/agpsets/440/index.htm>)

For more details on the Pentium II processor, please visit Intel's **Pentium II processor developer home page** or the **Pentium II processor web site**.

(<http://developer.intel.com/design/PentiumII/index.htm>)

(<http://developer.intel.com/PentiumII/home.htm>)

To stay on top of the latest news around AGP technology, please visit the **AGP technology news page** regularly in Platform Solutions newsletter. (<http://developer.intel.com/solutions/tech/agp.htm>)

Intel's Application Launch Accelerator Technology Loads Software Faster

by Rick Coulson

Intel Fellow and Director of I/O Architecture

Intel Corporation, Platform Architecture Lab

Intel Application Launch Accelerator (IALA) technology dramatically speeds up the time it takes for software applications to load from the hard disk drive by improving the performance of PC storage subsystems .

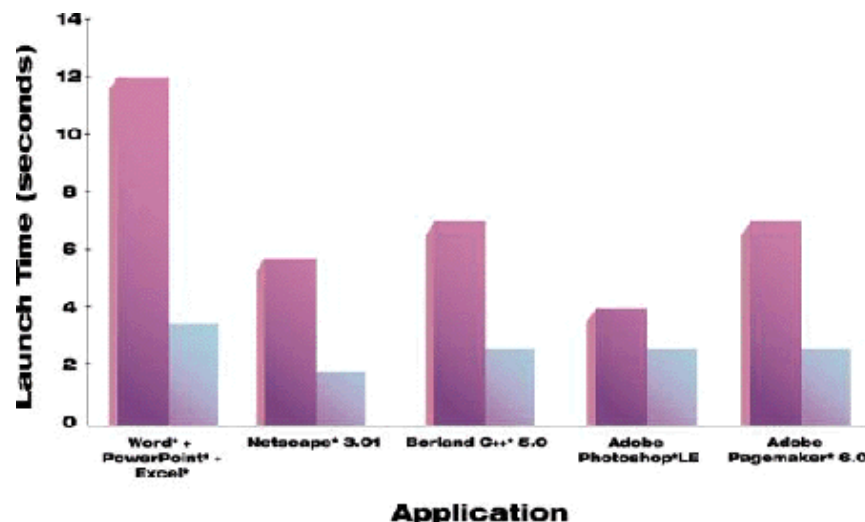
Although it's generally acknowledged that the hard disk drive is often the performance bottleneck in a PC, most workloads fail to make efficient use of the disk subsystem. The disk ends up spending more time seeking - moving its heads to the location where the data is stored - than it does actually transferring data. Existing defragmentation techniques attempt to address this by arranging individual files into consecutive clusters for sequential access, but because files are not typically read sequentially during application launch, many seeks remain—even after defragmentation.

IALA technology is based on an optimization technique that improves disk I/O performance by relocating disk blocks in a way that minimizes the service time required by the drive to fetch a given sequence of disk blocks. The sequence of data blocks used during application start-up are arranged in an optimized fashion, thereby reducing the number of time consuming random disk accesses—which take much longer than their sequential counterparts. Although the result may fragment the associated files on the disk, they're organized in the sequence in which the data is requested, thus reducing seek operations.

Measurable Differences in Launch Times

As a result of the IALA's optimizing algorithm, which minimizes the amount of head travel across the hard disk, users will see dramatic reductions in loading time when they launch applications on their PCs. A comparison of two otherwise identically configured Pentium® II processor-based systems—one with IALA technology, and one without—revealed substantial performance differences.

The IALA-enabled PC launched all three Microsoft® Office applications—Microsoft Word®, Microsoft Excel® and Microsoft PowerPoint®—in approximately 3.2 seconds, compared to 12.3 seconds required to launch the same applications on the PC without IALA technology. As the accompanying graph illustrates, other applications show similar improvements in launch times, typically providing a performance improvement of 2-2.5X.



Getting There Faster

Licensed to Microsoft for use in the upcoming release of Windows* 98, IALA technology reflects Intel's ongoing efforts to improve the performance and functionality of the PC platform. The technology was developed in part based on knowledge gained by Intel from the application of its new **IPEAK tools** (<http://developer.intel.com/design/ipeak>), which help to ease technology adoption and platform performance tuning for PC OEMs and Independent Hardware Vendors (IHVs).



OEMs can take advantage of the benefits of IALA technology by pre-optimizing the applications they load onto their system products to reflect IALA performance gains and provide end users with substantial advantages. Best of all, these benefits all can be realized without requiring any architectural changes to the overall system, I/O subsystem, or the application. Look for other new optimization technologies from Intel in the future.

About the Author

Rick Coulson is an Intel Fellow and Director of I/O Architecture in Intel's Platform Architecture Lab. His responsibilities cover all aspects of I/O performance for the Intel Architecture, including working with desktop storage architectures and interfaces, network solutions, graphics and chip set implementations.

Design High-Quality Audio at Lower Cost With Audio Codec '97 Version 2.0

*By Russ Hampsten
Audio Marketing Manager
Intel Corporation, Platform Marketing*

Audio technology is becoming increasingly important as the evolution of the PC platform converges with the world of consumer electronics. DVD and interactive multimedia applications are audio-intensive, and advances in processor power are driving the trend toward software implementations of high-quality PC audio, including 3D digital audio and Dolby AC-3 decode. The recently released Version 2.0 of the Audio Codec '97 specification provides the extensions that PC developers need to cost-effectively create new platforms with high-quality audio performance for delivery in 1998.

Benefits of AC '97 Version 2.0

To understand the value of AC '97 Version 2.0, it is first important to realize that it is not intended to be a replacement for AC '97. Rather, it is a set of extensions that enable the implementation of high-quality audio and that provide additional features with existing interfaces.

- It enables cost-effective modem/audio integration without ISA-based add-in cards.
- It allows the partitioning of codecs to enable modem-on-the-motherboard functionality.
- Finally, it supports the Audio '98 roadmap to higher quality audio on the PC.

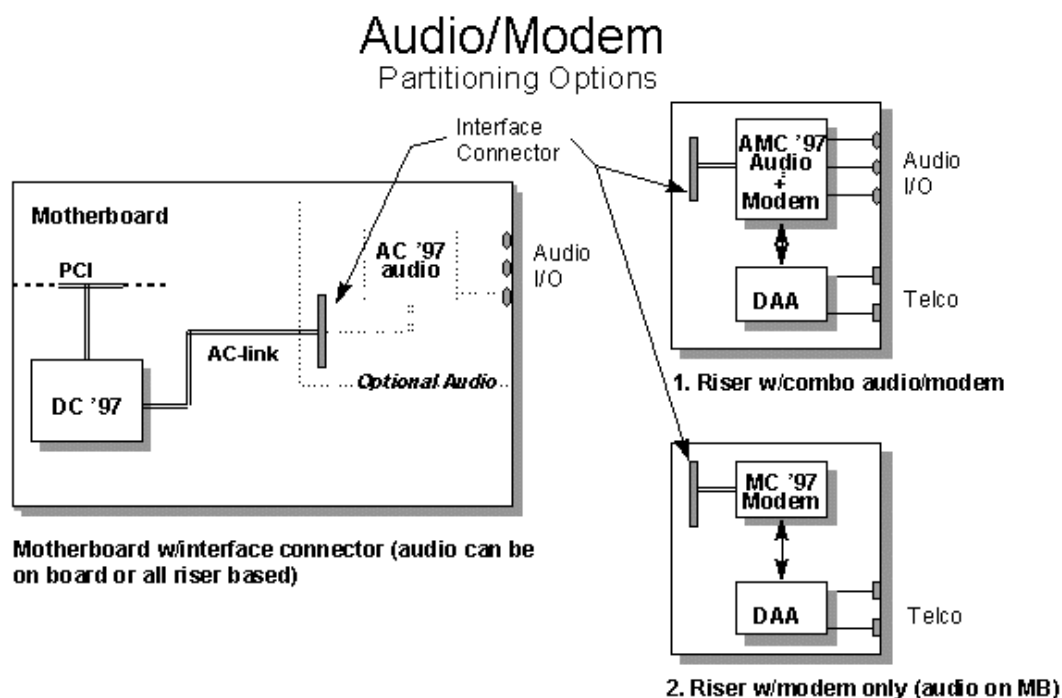
Until recently, the PC designer interested in creating high-quality audio on the PC at low cost has faced a paradoxical situation. Integration of the modem on the PC motherboard lowers cost, but the process of modem certification involves compliance issues with a multitude of communications standards in separate countries. The lengthy compliance process can exceed the typical life cycle of a motherboard design.

Cost-Effective Audio/Modem Solutions

The traditional modem consists of either an ISA (for internal modem) or a serial port (for external modem) interface, a command set controller, a data pump, a line codec and a DAA that interfaces to the telco network. Newer, lower cost modems (called "WinModems") save cost by performing the controller function on the host. Further cost-savings can be achieved with "soft-modems" or host-based modems, which perform both the data pump and controller functions on the host. This solution still requires the use of a PCI slot and PCI interface logic.

AC '97 Version 2.0 enables two cost-effective solutions, both of which integrate some functionality on a riser card attached to the motherboard:

1. The first solution integrates audio and modem line functions onto a single riser card using either a single codec (Audio Modem Codec, AMC '97) or multiple codecs (AC '97 + MC '97). (See diagram below.) This is a high integration solution which promises the most cost savings. It is also very scalable. The lone disadvantage of this approach is that it requires the implementation of both audio and modem on the riser card which has some connector packaging issues.
2. The second solution specifies two separate codecs, one for audio (AC '97) and one for the modem (Modem Codec or MC '97), with the modem codec and DAA partitioned to the riser card in order to simplify certification. This solution makes a soft-modem possible, with the elimination of the ISA I/F and the associated ASIC (see diagram below). By partitioning modem and audio functions separately, this solution offers optimum support for audio and low-cost, geographic-specific modem functionality.



AC '97 Version 2.0 provides an interoperable specification for integrating audio and communications functionality. These extensions do not involve changes to current AC-link timing and slot definitions, nor do they alter baseline audio functionality.

Use AC '97 Version 2.0 to Design 1998 Systems

Systems based on AC '97 Version 1.0 are ramping in the first half of 1998. AC '97 Version 2.0 is the next step in the evolution of high-quality audio on the PC. It enables higher-integration designs which eliminate the cost of legacy subsystems and buses, while helping to deliver high-quality DVD sound into the mainstream. The time to start designing with AC '97 Version 2.0 is now.

For system designs in 1998 and beyond, OEMs and IHVs should look to Intel's Audio '98 roadmap which describes a scalable architecture (from low-cost to high-performance) for audio on PCI, USB, and 1394. Audio '98 comprehends either "built-in" or "external" audio functionality to achieve "Digital-Ready" or fully "Digital-Only" audio solutions providing the highest quality sound to the mainstream PC user over the next few years.

About the Author

Russ Hampsten is the Audio Marketing Manager in Intel's Platform Marketing organization. He is responsible for driving new audio architectures and standards in the area of PC audio. Previously, Russ was an architect defining PC audio/telephony products and is co-author of Intel's Audio Codec '97 Component Specification (AC '97) versions 1.0 and 2.0 and the Audio '98 Roadmap.

For More Information

Additional information on AC '97, including AC '97 Version 2.0, is available on the **Intel Web site**. (<http://developer.intel.com/pc-supp/platform/ac97/index.htm>)

For more information on the **Audio '98 Roadmap**, visit the Intel web site. (<http://developer.intel.com/pc-supp/platform/aud98/index.htm>)

To keep in touch with the latest news surrounding Audio on the PC platform visit the **Audio Technology page** in Platform Solutions on a regular basis. (<http://developer.intel.com/solutions/tech/audio.htm>)

Have a technical question related to AC '97? E-mail Intel at audio97@intel.com

A New Wakeup Call for the Instantly Available PC—3.3Vaux ECR

*By Gary Solomon
Senior System Architect
Intel Corporation, Platform Architecture Lab*

New updates to the PCI Local Bus Specification and PCI Bus Power Management Interface Specification provide the industry's first standards-based approach for supporting power-managed PCI device wakeup. For PC OEMs and IHVs, this paves the way to reduced costs, broad product interoperability and greater efficiency in implementing the Instantly Available PC's "Off-Yet Communicating" capabilities.

As an important component of the industry's **Wired for Management (WfM)** initiative (<http://developer.intel.com/tech/wfm.htm>), the Instantly Available PC delivers a new range of intelligent power management capabilities. The next generation of feature-rich, high-performance PCs will be power-efficient, "always connected"—even when turned off—and instantly available to users and power management-aware software applications.

In **Issue #2** of *Platform Solutions* (<http://developer.intel.com/solutions/archive/issue2/stories/top2.htm>), we discussed Intel's ongoing efforts, disclosed for the first time at the Fall '97 Intel Developer Forum, to help the industry make the Instantly Available PC a reality in 1998. Earlier this year, Intel led the development of the new PCI Bus Power Management Interface Specification (PCI-PM) Revision 1.0, which broadened the plug-and-play capabilities of the PCI bus architecture to include a function's power management capabilities.

Need for a Standard Wakeup Solution

While the PCI-PM specification standardized the way to power-manage the PCI bus and its functions, it did not provide a comprehensive, standardized way to support PCI function wakeup from a sleep state (called the D3cold/B3 state) where main PCI bus power has been removed.

The PCI-PM Revision 1.0 specification defines the Power Management Event signal PME# (pin 19A) to enable PCI functions to awaken a PC from all "bus-powered" states. Enabling power management events from the D3cold/B3 state, however, requires PCI slot support for auxiliary power—which the PCI-PM Revision 1.0 specification did not define in a standard way.

System designers were forced to incorporate auxiliary power using non-standard techniques that typically have required either additional cables with a proprietary motherboard/add-in card interconnect, an external power source, or an on-board battery. The cost, interoperability, support and ease-of-use issues imposed by any of these non-standard solutions mandated a low-cost, plug-and-play standard solution for auxiliary power on the PCI bus.

Why is Wakeup Support from D3cold/B3 important?

PCI functions that have been designed to wakeup the system only from bus-powered states (i.e. not from D3cold/B3) create other dependencies on the system that affect the user's resultant experience.

For example, if a user with a modem that doesn't support PME# from D3cold/B3, launched his fax application prior to putting the system to sleep, the OS would ensure that the system is never transitioned to a sleep state where the PCI bus is without main power—even if the system supports such a state. Instead, the OS would transition the PC to the S1 or S2 sleep state, either of which maintains power to the PCI bus.

Unfortunately, with either of these two states, power is also maintained for the rest of the system, and the system fans are still spinning to keep the PC's internal temperature from rising. The PC's power consumption during S1 or S2 is approximately ten times what is achievable in the S3 state when D3cold/B3 is supported. An OEM who has designed an Instantly Available PC complete with "Off-Yet

Communicating” capabilities may be hesitant to integrate a modem, NIC or any other communications subsystem that cannot take full advantage of the system’s advanced capabilities.

3.3Vaux: Defining a New Standard

The Intel-chaired PCI SIG Power Management Working Group (PMWG) published a specification change request, which was recently approved by the PCI SIG Steering Committee, impacting both the PCI-PM Specification and the PCI Local Bus Specification. The architectural enhancements define a standard way to support PCI function wakeup from a state where main PCI bus power has been removed (i.e. D3cold/B3). The new 3.3Vaux ECR (Engineering Change Request) allocates a new PCI connector pin (pin 14A) for the 3.3Vaux voltage source, along with a comprehensive specification governing its delivery and consumption within a PC. It provides a standard way to keep any logic alive during the D3cold/B3 state that is required to alert the system to the occurrence of an event, such as a LAN packet of interest or phone ring.

Enabling the Instantly Available PC in 1998

The 3.3Vaux ECR rounds out a robust, standardized PCI bus-wakeup solution complementing the new PME# signal that was defined to trigger the wakeup event. New Instantly Available PC systems supporting PCI-PM with PME# and 3.3Vaux can take full advantage of the PCI-based “Off-Yet Communicating”-ready modem and NIC subsystems that will soon be available. They will also be able to take immediate advantage of emerging technologies that will continue to appear as a result of the PCI-based communications treadmill and the Wired for Management Initiative.

The 3.3Vaux ECR’s prescribed changes to the PCI Bus Power Management Interface will become part of Revision 1.1 of the specification. Changes to the PCI Local Bus Specification will be rolled into Revision 2.2. You can expect both of these specifications to be available by early 1998. Intel has already updated its Instantly Available PC Power Delivery Requirements and Recommendations specification (formerly known as Power Supply '98), along with the Instantly Available PC Design Guide, to account for the changes specified by the 3.3Vaux ECR.

About the Author

Gary Solomon is a Senior Architect in Intel’s Platform Architecture Lab. He is a principal technical contributor chartered with advancing the PC platform. Gary is currently working on Instantly Available PC and Audio technologies.

For More Information

The following documents are available for download at **Intel’s Developer web site**. (<http://developer.intel.com/ial/powermgm/specs.htm>)

- PCI Bus Power Management Interface Specification
- 3.3Vaux ECR
- Instantly Available PC Design Guide
- Instantly Available PC System Power Delivery Requirements and Recommendations

Stay tuned to the **Instantly Available PC technology page** in Platform Solutions for the latest news on a monthly basis. (<http://developer.intel.com/solutions/tech/power.htm>)

The Best Way to Implement 1394 Technology: Q&A With Intel's 1394 Experts

David L. Fair
1394 Program Manager
Intel Corporation, Platform Marketing

Bill Pearson
1394 Technical Marketing Engineer
Intel Corporation, Platform Marketing

Q1. Will 1394 replace USB?

A1. Fair—No. 1394 and Universal Serial Bus (USB) are complementary technologies. USB offers a low-cost, medium-bandwidth (12 Mbits/sec.) connection for telephony products, digital cameras, monitors, keyboards, mice, and other I/O devices. In contrast, 1394 is a high-speed bus designed for digital video cameras, DVD players, mass storage devices and other peripherals that require greater bandwidth. P1394a allows data transfer speeds of 400 Mbits/sec., and development is underway to allow 1394 speeds to reach 800, 1,600, and ultimately 3,200 Mbits/sec. 1394 and USB will peacefully coexist in tomorrow's PCs, both providing plug-and-play ease of use, but each servicing a different class of peripherals.

Q2. Why does Intel support 1394?

A2. Fair—1394 is the "Digital Convergence Pipe" for connecting the PC with emerging digital consumer electronics devices including digital camcorders, DVD players, digital VCRs and eventually, HDTV. 1394 also offers a high-bandwidth, plug-and-play connection to Intel Pentium® II processors that can be exploited by traditional PC peripherals including hard disk drives, printers, and scanners. For some devices, such as printers and digital still cameras, 1394 offers bandwidth which allows peripheral manufacturers to exploit host-based processing—rather than peripheral hardware—for lower cost peripherals.

Q3. Is 1394 a cost-effective solution?

A3. Fair—Like any new technology, 1394 is more expensive to implement than many of the very mature technologies it replaces. However, Intel believes that volume deployment of 1394 will rapidly drive down costs and ultimately eliminate cost as an issue. Because it is a serial bus and only employs six wires, in the long run 1394 should become cheaper than parallel buses like SCSI, IDE, and 1284. As 1394 moves to replace these consumer-unfriendly legacy interconnects, the total platform costs associated with I/O connectivity should actually decline—even *before* one considers total cost of ownership reductions. As mentioned before, host-based processing can reduce peripheral costs. Finally, the isochronous data transfer capability inherent in 1394 allows designers to move processor and memory-intensive functions off the peripheral device to the PC, while reducing the size of data buffers on the device side to reduce cost yet further.

Q4. Does Intel plan to integrate support for 1394 into future motherboard designs?

A4. Fair—Intel is committed to 1394 and believes that P1394a is the right specification for use in tomorrow's PCs, especially as a connection to consumer electronics devices. Intel has not publicly announced products or schedule dates for products incorporating 1394 technology.

Q5. Why is Intel designing with P1394a when the spec still is not finalized?

A5. Fair—As with any unratified specification, early implementors must accept some risk. However, Intel believes that the P1394a specification involves so many improvements that it is definitely a major

improvement over 1394.1995. Intel believes that P1394a is a much better starting point for new designs than 1394.1995.

Q6. My device only needs 50-Mbits/sec. bandwidth. Why should I use an S400 PHY?

A6. Pearson—You should use the fastest available PHYs to be a good “bus citizen” and allow every 1394 device to get adequate bandwidth. To answer this question, let’s look at an example. If you have a device that has an S100 PHY, and you use 50 Mbits/sec., you will take up one-half of the bus. This means that any second device with an S400 PHY has only 200 Mbits/sec. of bandwidth available to it. In order to obtain the maximum bandwidth for everyone, all devices should use S400 PHYs. This allows more devices to use the bus, results in more efficiency and creates the best balance of system resources.

Q7. Does P1394a enable greater speeds than 1394.1995?

A7. Pearson—P1394a and 1394.1995 both specify S100, S200 and S400 speeds. The performance advantages of P1394a derive from protocol enhancements such as fly-by arbitration, ack-accelerated arbitration, and fairness optimization. The sum of these improvements is actually greater than the contribution of each alone. For details, see the sidebar: **Protocol Enhancements in P1394a**. (<http://developer.intel.com/solutions/tech/p1394a.htm>)

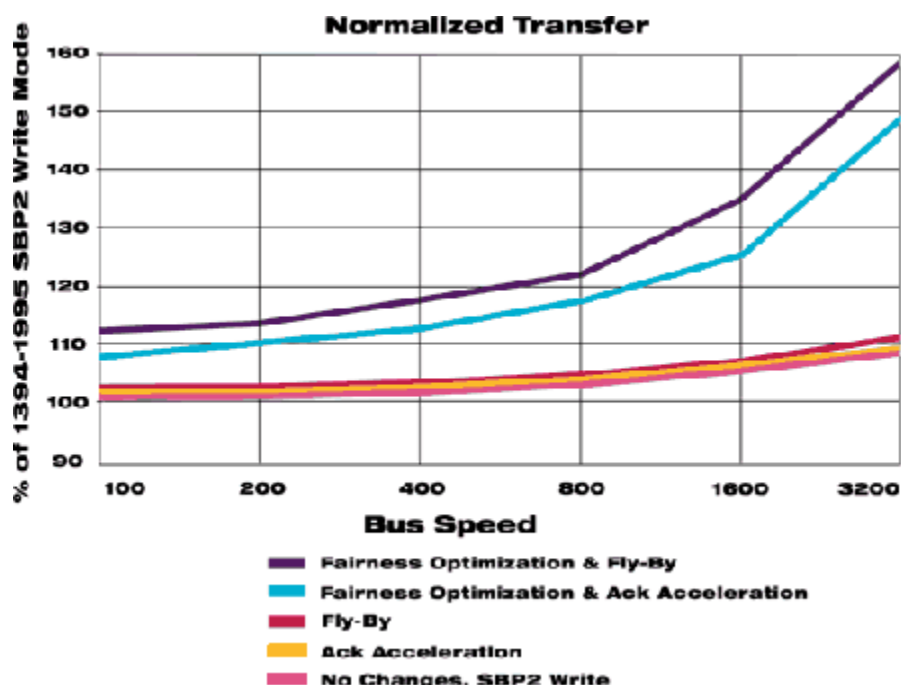
Q8. What can developers do now to benefit from 1394 technology?

A8. Pearson—To assure interoperability, develop new products which precisely implement P1394a with an S400 PHY. Intel encourages developers to attend the February **Intel Developer Forum** (<http://developer.intel.com/design/idf>). The 1394 technical track at IDF will provide a wealth of implementation information, as well as an opportunity to get answers to specific design related questions.

Q9. Where can I get more information?

A9. Pearson—The 1394 Trade Association has a great deal of information on cables, connectors and silicon available for developers at its **1394 TA Web site** (<http://www.1394ta.org/>). You can also visit the **1394 Technology page** (<http://developer.intel.com/solutions/tech/1394.htm>) in Platform Solutions on a regular basis to stay in touch with the latest news on 1394 implementation on the PC platform.

Protocol Enhancements in P1394a



1. **Connection Hysteresis (Debouncing)**—When a connector is inserted or removed from a socket, a clean connection is never made. What this means is that electrical connection is made and broken many times within a very short period. The 1394.1995 standard does not take this into account. Whenever a device is connected or disconnected from the 1394 bus, a bus reset occurs. The connection or disconnection of a device actually creates storms of bus resets which disrupt isochronous traffic on the bus. P1394a solves this problem by specifying a connection time-out when devices are connected or disconnected, so only one bus reset will occur each time a device is connected or disconnected from the 1394 bus.
2. **Arbitrated (Short) Bus Reset**—The 1394.1995 definition of bus reset assumes that the state of the bus is not known when a bus reset is initiated. The minimum reset assertion time must be long enough to complete any packet transmission that may have been in progress, assuming that uninterrupted packet transmission is desired. However, if reset is asserted after first arbitrating for the bus, the minimum reset time can be significantly reduced. This is due to the fact that if one node has arbitrated and won the bus, no other node can be transmitting at that time.
3. **Transmission Delay Calculation (PHY Pinging)** —In principle, PHY-to-PHY pinging is the same as the classic ping. One PHY sends a ping to another PHY in order to determine the signal delay time. Knowledge of the delay allows the use of cables longer than 4.5 meters, or PHYs with a delay time of more than 144 ns on the 1394 bus.
4. **Multi-speed Packet Concatenation**—This corrects a defect in 1394. 1995 which requires a PHY to send a speed signal with only the first transmit packet of a multi-packet sequence, and at the same time requires a separate speed signal for each receive packet in a multi-packet sequence. P1394a corrects this defect by requiring a separate speed signal for each packet of a multi-packet sequence. When the PHY repeats a packet that has no speed signal, it does not add one. Instead it assumes that the speed signal will be the same as the previous packet.
5. **Arbitration Improvements**—Fly-by allows a packet to be concatenated without arbitration and ack-accelerated arbitration allow a node to arbitrate for the bus without first observing a subaction gap. Fly-by arbitration occurs when a primary packet is observed and then propagated toward the root.

That is, when a packet is received on a child port, concatenation can occur for two cases. In the first case, if the packet is an acknowledgement packet, an unrelated asynchronous packet could be concatenated on-the-fly. In the second case, if the packet is an isochronous packet, an isochronous packet could be concatenated on-the-fly. Ack-accelerated arbitration occurs following the observation of an acknowledgement packet. This is based on the fact that 1394.1995 made no distinction between an acknowledgement packet and a regular packet. Since there will be no acknowledgement packet following an acknowledgement packet, the subaction gap detect time can be eliminated. This allows arbitration to begin immediately following the acknowledgement packet.

6. **Token-style Arbitration**—This is a mechanism that allows a group of cooperating nodes to transmit packets in a token-style implementation. First the node closest to the root arbitrates and then yields the arbitration to the node farthest from the root. This node transmits, and then each subsequently closer node transmits, using either fly-by or ack-accelerated arbitration to concatenate their transmissions, thereby eliminating the need for subaction gaps.
7. **Port Disable (Per Port Software Disconnect)**—This is a simple mechanism that allows a 1394 port to be shut down by software. A disable bit is sent to the desired PHY. The PHY is then disabled and does not respond to any traffic.
8. **Fairness Optimization**—A mechanism for a node to be granted permission to use priority arbitration during the asynchronous period. This basically lets a given PHY transmit more than once per period. The maximum number of requests is 63 minus the node count.

About the Author

David L. Fair is the 1394 Program Manager in Intel's Platform Marketing organization. He is responsible for successful implementation and enabling of 1394 on the PC platform with the industry.

Bill Pearson is the 1394 Technical Marketing Engineer in Intel's Platform Marketing organization. He is responsible for supporting the industry on 1394 implementations on the PC platform.

For More Information

For lots of detailed information on 1394 implementation, visit the **1394 TA Web site**. (<http://www.1394ta.org/>)

To stay in touch with the latest 1394 platform news, read the **1394 Technology news page** updated monthly. (<http://developer.intel.com/solutions/tech/1394.htm>)

Platforms:

Business Platforms

What's New

- Intel Developing Guidelines For **Lean Client And Network Server** To Support Variety Of Operating Environments. New End-to-End Intel Platform Will Expand Range of Business Computing Systems. (<http://www.intel.com/pressroom/archive/releases/LC120397.HTM>)
- Intel showcases **platforms for the Enterprise** at Fall Comdex. Intel's Vice President of Business Client Marketing, Will Swope, gives an overview of Intel's Enterprise platform enabling efforts in Issue #3 of Platform Solutions. (<http://developer.intel.com/solutions/archive/issue3/stories/top1.htm>)
- Intel has updated the **Wired for Management ToolKit** with latest WfM Building Blocks including a New WfM Design Guide to help Developers implement WfM Capabilities. (<http://developer.intel.com/ial/wfm/>)
- Intel Architecture Puts **Java* to Work**. (<http://www.intel.com/businesscomputing/archive/tech3.htm>)

Overview

The proliferation of hardware and software choices, and the explosion of the Internet and Intranet have made the business computing environment increasingly complex and expensive to deploy and manage. Intel is continuing to bring greater performance and capability to the standard business desktop PC, while at the same time increasing its efforts to make it easier to deploy and control.

With the introduction of the Pentium® II processor Intel has combined the power and capabilities of the Pentium® Pro processor with the multimedia and communications capabilities of MMX™ technology. Along with platform technologies like Accelerated Graphics Port (AGP), the standard business desktop now has the **visual computing** (<http://developer.intel.com/solutions/archive/issue1/focus.htm>) capabilities of PC imaging, 3D graphics, and enhanced video processing that will take business computing to the next level and change the way businesses work with each other and with consumers.

Intel is now working with the industry on technologies that reduce the total cost of ownership and make PC's inherently easier to manage. The Wired for Management (WfM) initiative and Network PC (Net PC) platform are two examples of the tremendous progress made to enable greater control and lower Total Cost of Ownership (TCO).

Wired for Management

Intel's Wired for Management (WfM) initiative is part of a broad-based industry effort to reduce the costs of business computing without compromising compatibility or performance. The initiative includes new hardware and software products to help OEMs and others implement WfM capabilities, alliances with other industry leaders, education and development programs, and Intel-led industry efforts aimed at developing widely accepted manageability standards. Most importantly, the WfM initiative targets real reductions in support costs, the most expensive element of business computing.

The WfM Baseline Specification establishes a minimum set of management capabilities such as remote configuration and installation of operating systems and software applications, remote system inventory and monitoring, and after-hours maintenance. OEMs can build further capabilities on this baseline to deliver even more value to their customers.

Network PC (Net PC)

The Network PC, or Net PC, was born out of Intel's WfM initiative to reduce TCO and increase control without sacrificing necessary performance. The Net PC introduces a new category of business PC designed from the ground up to be centrally managed, while simultaneously delivering the power and versatility of a traditional business desktop computer. The benefits of the Net PC include remote system configuration over the network, automated distribution of software, simplified remote diagnosis and maintenance, asset management support and a sealed chassis. The built-in manageability features and locked chassis of the Net PC give IT (Information Technology) support staff a known entity, while at the same time locking systems to reduce unauthorized or unplanned changes in the client.

Wired for Management

What's New:

- Wired for Management Baseline specification version 1.1a **FAQ now Available**
(<http://developer.intel.com/ial/dmi/support/faqs.htm>)
- Intel **LANDesk® Management Suite 6** Helps Reduce Support Costs; Facilitates First-Call Problem Resolution Efforts for Windows NT* and NetWare* environments
(<http://www.intel.com/pressroom/archive/releases/LD102197.HTM>)
- Intel announces availability of **LANDesk® Client Manager v3.1** to Lower Costs with Wired for Management Support
(<http://www.intel.com/pressroom/archive/releases/LD092997.HTM>)
- Intel updates **Wired for Management ToolKit** with latest WfM Building Blocks:
(<http://developer.intel.com/ial/wfm/>)
 - Wired for Management Design Guide
 - Intel DMI 2.0 Service Provider SDK
 - Managed Object ToolKit
 - Intel Mobile Component Instrumentation SDK version 1.0
 - Intel DMI SDK for Servers
- Wired for Management **Baseline Specification Version 1.1a** available
(<http://www.intel.com/managedpc/spec.htm>)
 - Now Includes Mobile and Server
- Intel Developing Guidelines For **Lean Client And Network Server** to Expand Range of Business Computing systems
(<http://www.intel.com/pressroom/archive/releases/LC120397.HTM>)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

"Manageability" is a **BIG** subject and the focus of several industry-wide initiatives. Intel's Wired for Management (WfM) initiative seeks to raise the level of management capabilities for mobile, desktop, and server platforms. The complementary Zero Administration for Windows* initiative from Microsoft* seeks to create more manageable operating systems and applications. The collective goal of these initiatives is to help plan, deploy, proactively maintain, and centrally control a distributed computing environment, in order to reduce the overall cost of owning and managing computers in the enterprise.

The WfM Baseline describes a consistent set of management capabilities which defines the minimum functions delivered in a target platform. These include requirements for instrumentation, remote wake-up, power management, and service boot capability. Along with the WfM Baseline specification, Intel has produced a set of development tools designed to ease deployment of these capabilities. These include the Intel DMI 2.0 Service Provider SDK, the Managed Objects Toolkit for rapidly developing management applications, the Mobile Component Instrumentation SDK for laptops, and the DMI SDK for Servers. Intel has also made available a WfM Design Guide showing the "how-to" details on implementing the WfM capabilities.

Benefits to Users:

The benefits of WfM Baseline-compliant systems are clear. It enables centralized system management: inventory, fix/repair, configuration and diagnostics, and provides for off-hours maintenance to minimize downtime. Picture a user who's having a problem with a built-in fax program and calls the company support hotline. The user continues using the system while a support technician remotely views the user's configuration and discovers that some files are mismatched to the hardware. The technician makes the needed changes and updates the correct files, all in the background, while the user continues working. Another common scenario is where the IT administrator updates to the latest version of the office productivity application suite automatically during the middle of the night without any user intervention.

Benefits to Manufacturers:

The WfM Baseline is easy for OEMs and developers to adopt and deploy and is based on industry standard management technology. DMI 2.0, for example, is a non-proprietary interface that is easy for vendors to adopt. In addition, DMI is independent of any specific operating system, hardware platform or management protocol. The interface is scalable to accommodate a wide range of products and mappable to existing management and remoting protocols.

Intel's Wired for Management ToolKit makes it easy for OEMs, IHVs, and ISVs to adopt and deliver management capabilities. The tools encourage the addition of value-added features on top of the WfM Baseline within its open-specification structure. The Baseline also provides a consistent target for applications developers including enterprise-wide management solutions.

Industry Status:

Since its initial release in April 1997, the WfM Baseline specification and its companion, the Network PC (Net PC) specification, have received wide industry support from a variety of key industry players. For more information on **supporting companies** see:

<http://www.intel.com/pressroom/archive/releases/nw31297b.HTM>

For Mobile, visit <http://www.intel.com/pressroom/archive/releases/NW060297.HTM>,

For Server, visit <http://www.intel.com/pressroom/archive/releases/wm063097.htm>

Evidence of the widespread momentum for the WfM initiative was demonstrated at the second Intel WfM interoperability workshop on September 26, 1997. Over 20 industry leaders tested the interoperability of manageable platforms and management software showing that Manageable PCs and Net PCs are here now and so are the tools to manage them (see the **press release** describing the event at <http://www.intel.com/pressroom/archive/releases/WM092997.HTM>).

Intel also provided detailed technical training and tools to further assist OEMs and IHVs in implementing the WfM Baseline specification at the Intel Developer Forum held on September 29, 1997. For more information on the **IDF WfM track** please go to (<http://developer.intel.com/ial/dmi/class/index.htm>).

Intel and Microsoft are working closely to align their management technologies. This is evident in the work that produced the Network PC (Net PC) specification, which was co-authored by Intel and Microsoft along with other industry partners. The two are continuing to assure that next generation Windows* operating systems are compatible with today's management technologies. This includes joint work on the *PC 98 System Design Guideline* released in September 1997, and the *Windows Hardware Instrumentation Implementation Guide* (WHIIG) expected to be available in early 1998.

Next Steps:

Specifications have been available for both the WfM Baseline and the Net PC since early 1997. Tools and training have been delivered to the industry. Two interoperability events have been held showing the momentum behind the WfM Baseline and the arrival of product building blocks. If you are currently designing systems or products for desktop PCs, mobile PCs, or servers, now is the time to design and deliver WfM-based products so that businesses can take advantage of this technology to reduce total cost of ownership.

If you missed the Intel Developer Forum (9/29/97–10/1/97), check out all the presentations on-line (<http://developer.intel.com/ial/dmi/class/index.htm>). Check out the IDF web site (<http://developer.intel.com/design/idf/>) for event and registration information on the **next IDF in February 1998**.

For More Information:

For more information on Mobile manageability, please visit the **Mobile PC Manageability site** (<http://www.intel.com/mobile/entrprse/managePC/index.htm>).

Helpful development tools may be downloaded from the **Wired for Management ToolKit** site for immediate deployment (<http://developer.intel.com/ial/wfm/>).

For more information on the **Network PC (NetPC)** visit Intel's Net PC web site at (<http://www.intel.com/businesscomputing/netpc/>).

For information on Intel's building blocks and **manageability products** and solutions visit (<http://www.intel.com/managedpc/product.htm>).

For more information on **DMI and the DMTF** visit the industry DMTF web site at (<http://www.dmtf.org>).

Intel's **Managed PC** web site contains information on WfM targeted at IT professionals (<http://www.intel.com/managedpc/index.htm>).

For information on Microsoft's **Zero Administration for Windows (ZAW)** initiative visit their web site at (<http://www.microsoft.com/windows/zaw/>).

Network PC (Net PC)

What's New:

- Intel announces availability of **LANDesk® Client Manager v3.1** to Lower Costs with Wired for Management Support
(<http://www.intel.com/pressroom/archive/releases/LD092997.HTM>)
- Wired for Management Specification 1.1a Available
(<http://www.intel.com/managedpc/spec.htm>)
- Second WfM Baseline and **Net PC Interoperability Test Event** Held 9/26/97
(<http://www.intel.com/pressroom/archive/releases/WM092997.HTM>)
- **Net PC Case Studies** show advantages of Net PCs
(<http://www.intel.com/businesscomputing/netpc/>)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

The Network PC, or Net PC, is a new category of business PC intended to reduce ownership costs through its advanced management capabilities while delivering the power and versatility of traditional business PCs. Advanced system administration features, including remote configuration and repair and the ability to “wake up” systems for off-hours maintenance, give IT organizations greater centralized management capabilities while retaining existing LAN infrastructures. Hard disk drives give users the choice of running their Windows*-based business software and storing data locally or on servers.

The Network PC System Design Guidelines specify a number of advanced manageability features that enable easy, central administration. These include:

- **Remote boot.** The system can boot from a management server to receive downloads or updated operating system software or applications.
- **Remote wake-up (Wake-On-LAN* technology).** The system can be turned on remotely for after-hours maintenance.
- **DMI 2.0 support.** System elements using the Desktop Management Interface can be recognized and managed by industry-standard management software.
- **Instrumentation.** System elements such as the baseboard, processor, disks, mouse, keyboard, BIOS and video card can identify themselves and provide management information to standards-based management software.
- **SMART hard drive.** The disk can indicate when it may be about to fail, giving the user time to avoid data loss.
- **Hardware monitor.** The system tracks various indicators of hardware health, such as temperature or chassis open.

Net PCs are “managed” business PCs that cover the full range of price/performance, including high-power systems based on Intel's Pentium® II processor. Products based on the guidelines are emerging at a wide range of performance levels and price points. The Net PC System Design Guidelines was developed by Intel, Microsoft*, Compaq*, Dell* and Hewlett-Packard*.

Benefits to Users:

With its advanced management technologies, controlled configurations and sealed case, the Net PC gives IT managers increased control over the distributed computing environment. In addition, The Net PC offers a platform that is cost-effective to deploy, manage and support, without sacrificing the desktop computing power, local storage and application flexibility that make the PC a versatile and powerful tool for users. By combining PC versatility and performance with centralized, network-based manageability, the Net PC truly delivers a valuable new tool for business. The Net PC is most appropriate for companies centralizing PC management and for those data- and task-focused users who need no hardware expandability. For example, it is ideal for information delivery, customer support, manufacturing, finance and training.

Benefits to Manufacturers:

The overall Net PC solution is spurring the adoption of manageability by driving initiatives to increase base client management capability. By designing to the Net PC System Design Guidelines OEMs will be able to integrate network-based remote manageability features into their business desktop PC product lines.

Industry Status:

Intel's announcement of the Wired for Management (WfM) initiative in September 1996 generated considerable enthusiasm for managed PCs from OEMs, independent workgroup and enterprise management software vendors, and end-users. Intel has followed up the initial announcement with a series of events and tools delivered to the industry in 1997. The following events have taken place this year to further enable manageability in PCs and servers:

- *Publication of the Wired for Management Baseline 1.0*
- *Publication of the Net PC System Design Guidelines*
- *Net PC Interoperability events (June and September)*

- *Net PC Introduction and Product Announcements*
- *Publication of the Wired for Management Baseline 1.1a*
- *Publication of the Wired for Management tool kit*
- *Introduction of LANDesk® Client Manager v3.1*
- *Introduction of LANDesk® Management Suite 6*

The second WfM Baseline and Net PC Interoperability test was held on September 26, 1997. Over 20 OEMs, IHVs, and Manageability vendors attended and tested their products showing that Manageable PCs and Net PCs are here now and so are the tools to manage them (see the **press release** describing the event at <http://www.intel.com/pressroom/archive/releases/WM092997.HTM>).

Intel also provided detailed technical training and tools to further assist OEMs and IHVs in implementing the WfM Baseline specification at the Intel Developer Forum held on September 29, 1997. For more information on the **IDF WfM track** please go to (<http://developer.intel.com/ial/dmi/class/index.htm>).

Net PC systems began shipping from OEMs in the third quarter of 1997.

Next Steps:

Specifications have been available on both the WfM Baseline and the Net PC since early 1997. Tools and training have been delivered to the industry. Two interoperability events have been held showing the momentum behind WfM baseline and Net PC and the arrival of product building blocks. Now is the time for OEMs, IHVs, and Manageability software vendors to design and deliver WfM-based and Net PC products so that businesses can take advantage of this technology to reduce total cost of ownership.

Stay tuned to Platform Solutions for the next WfM and Net PC Interoperability Event expected in the first half of 1998, and news on the **next Intel Developer Forum** (<http://developer.intel.com/design/idf>) in February 1998.

For More Information:

For more details on Net PCs, visit **Intel's Net PC web site** at (<http://www.intel.com/businesscomputing/netpc/>).

For more details on the Wired for Management initiative from an IT perspective, visit **Intel's Managed PC web site** at (<http://www.intel.com/managedpc/index.htm>).

For all the instructions, tools, and specifications for delivering Wired for Management systems and products, visit the **WfM Toolkit site** at (<http://developer.intel.com/ial/wfm/>).

Platforms: (continued)

Home Platforms

What's New

- Intel's reorganization forms **new Consumer Products Group** to focus on consumer desktop PCs, TV Set-Top Computers, and Automobile PCs.
(<http://www.intel.com/pressroom/archive/releases/CN112497.HTM>)
- Fall Comdex shows how **Intel is enabling new Home platforms** for Entertainment, Creativity, and Education. Read Issue #3 Top Story by John Davies, Intel Vice President and Director of Consumer Desktop Products
(<http://developer.intel.com/solutions/archive/issue3/stories/top3.htm>)
- Intel Releases **971 PC Camera Kit** for Production of Affordable, Easy-to-Use, Portable PC Cameras
(<http://www.intel.com/pressroom/archive/releases/pi110397.htm>)
- Intel Guidelines Bring **More Compatible and Interactive DVD Titles** to PCs
(<http://www.intel.com/pressroom/archive/releases/IV102997.HTM>)

Overview

The Home PC is already the center of creativity, entertainment and education in many households today. With the advent of the Pentium® II processor and Dual Independent Bus (DIB) architecture, and new platform technologies such as AGP, USB and DVD, the home PC is bringing new compelling capabilities to both experienced consumers and first-time buyers. The introduction of Intel's Pentium II processor, when combined with the Internet and the emergence of PC photo processing, video editing, 3D graphics, digital audio, and video phones, is changing the way we work, learn, play, and communicate using our PCs at home.

Advancing the processor and platform technologies is critical to driving new levels of performance and capability that enable new and exciting PC platform uses. These new platform technologies go hand in hand with the enhanced capabilities of the Pentium II processor. Now available at speeds of 233, 266, and 300 MHz, the Pentium II processor combines the advanced features of Intel's sixth-generation processor, like Dynamic Execution and Dual Independent Bus architecture, with the enhanced multimedia and communications processing power of MMX™ technology.

The Pentium II processor delivers the best performance on all three vectors of computing: integer execution, delivering higher performance on all consumer software; floating point, delivering improved 3D graphics for more realistic images and games; and multimedia, using MMX technology to deliver improved imaging, video, and communications. When combined with Intel's newest AGP chipset, arcade quality graphics and DVD are possible now on the mainstream consumer PC.

Educated consumers are demanding the best PC performance to be ready for new and exciting applications. Multipurpose PCs are evolving into special categories focused to meet the needs of these educated consumers. Two major trends have emerged in consumer PC usage today: creativity and entertainment. Intel is enabling platform improvements that support these trends through the Creativity PC and the Entertaining PC initiatives.

Creativity PC

The **Creativity PC** (<http://developer.intel.com/solutions/tech/creapc.htm>) enables enhanced multimedia and imaging capabilities to make possible:

- Personal photography and albums
- Audio mixing and remixing
- Video editing
- Communicating your creations with family and friends

The emergence of low-cost digital cameras with USB connectivity is making the Creativity PC a hot new category this year. These cameras utilize the PC processing power of the Pentium II processor with MMX technology to allow you to capture, store, edit, and send digital photos over the Internet.

Entertaining PC

The Entertaining PC takes the traditional consumer desktop multimedia PC to a new level of capability using the Pentium® II processor, DIB architecture, AGP, DVD, and AC '97 Audio. Consumers who enjoy games and edutainment will now be able to experience a dramatic new level of 3D realism. With the inclusion of DVD drives, the Entertaining PC allows the user to play back high-quality DVD movies and take advantage of rich interactive DVD applications. With DVD, ISVs are taking advantage of the increased storage capacity to provide higher quality video, audio and graphics in games, edutainment and reference applications. Please see the following pages in Platform Solutions to learn how Intel is enabling these critical Entertaining PC platform technologies.

- **AGP** (<http://developer.intel.com/solutions/tech/agp.htm>)
- **DVD** (<http://developer.intel.com/solutions/tech/dvd.htm>)
- **Audio** (<http://developer.intel.com/solutions/tech/audio.htm>)

Education Usage Model

The Education usage model views the PC as a powerful complementor to the traditional learning process, making the educational experience more interesting, interactive and fun for students of all ages. Creativity PCs and Entertaining PCs are ideal platforms for compelling new educational applications that include realistic 3D graphics, video, 2D and 3D audio, and internet connectivity.

Developers might consider how they can add value in the growing educational applications market segment. For example, today's new Pentium II processor based systems create the hardware headroom which will enable the emergence of powerful new 3D graphics education software applications during 1998. Fast bitmap animation, fast intuitive interfaces, and reference works containing detailed 3D simulations with smooth video and high quality audio all have the potential to transform education for children. These learning tools will be enhanced further as DVD-based interactive software titles become available in increasing numbers in 1998. Most importantly, these new systems will not only support compelling teaching and learning applications for children around the world, these powerful new PCs will become increasingly affordable for use in schools.

Creativity PC

What's New:

- See what Intel is doing on-line to **promote creativity** to consumers. Web surfers can learn how to create on-line photo albums or send an internet post card at the **Connected PC site** (<http://connectedpc.com/sites/connectedpc/>)
- Understand **Intel's PC Imaging vision** directly from Peter Green, General Manager of Intel's Digital Peripherals Division, in Issue #3 Top Stories

(<http://developer.intel.com/solutions/issue/stories/top4.htm>)

- Intel Announces **New 971 PC Camera Kit** for Production of Affordable, Easy-to-Use, Portable PC Cameras
(<http://www.intel.com/pressroom/archive/releases/pi110397.htm>)
- Check out Intel's **New PC Imaging Web Site for Developers**
(<http://www.intel.com/design/imaging/>)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

The Pentium II processor, when combined with cool creativity software, enables new capabilities in:

- Video editing and playback (splice 'n dice your own videos)
- Audio remixing (Mix your own sound tracks)
- PC Imaging (capture, edit images, store and share with friends)
- Web Publishing (communicate with family and friends)

Imaging software has exploded with many popular titles designed for Intel MMX™ technology which brings significant performance to the category. Today digital cameras, scanners and photo printers are widely available at affordable prices. Audio creativity has hit mainstream. Previously audio was available only to musicians with special input devices and complicated software. Now with consumer software and the power of the Pentium II processor, anybody can be a musician.

Some of the features expected on the 1H'98 Pentium II processor-based Creativity PC SKUs are: video capture; audio and video in/out connectors; USB connectors; CD-recordable/Zip drive; PCI audio (AC'97); POTs video conferencing camera; software for video, image, and music editing.

PC OEMs also have the opportunity to include imaging peripherals like scanners, photo printers, and digital cameras.

Other technologies developing on the consumer platform to support Creativity PCs either now or in the future are:

- **USB**—(<http://developer.intel.com/solutions/tech/usb.htm>)
- **1394**—(<http://developer.intel.com/solutions/tech/1394.htm>)
- **AGP**—(<http://developer.intel.com/solutions/tech/agp.htm>)
- **DVD**—(<http://developer.intel.com/solutions/tech/dvd.htm>)
- **Digital Audio**—(<http://developer.intel.com/solutions/tech/audio.htm>)

Benefits to Users:

The Pentium II processor-based PC is the center of Creativity. It is unparalleled in handling pictures and video on your PC. New uses for consumers include photo management and albums, photo editing, personal publishing, Internet post cards, video editing, music creation, and 3D for fun. Here are some examples of what consumers can do with their creativity PCs:

- Entertainment: digital "shoe-box," personalized cards, family tree, games, hobbies, home movies
- Utility: book reports, asset inventory, home improvements
- Sharing: E-mail, WWW, prints
- Video/image management: archival, retrieval
- Image manipulation: enhancement, orientation, size
- Video editing: add text, special effects, transitions

- Small business: presentations, sales collateral, product catalogs, brochures, newsletters, publishing

The PC just got more exciting with the Creativity PC!

Benefits to Manufacturers:

New opportunities to sell new PCs and peripherals. Consumers are looking to buy digital cameras and PCs that have creativity capabilities.

Industry Status:

Creativity PCs are available now! PC OEMs are quickly recognizing the purchasing power of this prospective audience. New creativity PCs are available now from major manufacturers. More are expected in 1998 as the Pentium II processor moves into the volume mainstream.

Intel has developed the new 971 PC Camera kit to enable the production of affordable, easy to use, portable PC Cameras in 1998 from many independent manufacturers. This should help grow the Creativity PC category.

Next Steps:

Offer Pentium II processor-based Creativity PC SKUs in 1H'98 with video editing software, video capture, CD-recordable storage, audio and video in/out. Look for opportunities to sell peripherals and software as part of your Creativity PC SKU. Other opportunities include providing incentives for end-user purchase of peripherals and software.

Take advantage of Intel's Pentium II processor advertising campaign and promote the Creativity PC in the channel and in your advertising to increase awareness for the category.

For More Information:

Intel's **new PC Imaging site for developers** with lots of information on PC Cameras (<http://www.intel.com/design/imaging/>)

Lots of information available on the usage of Intel's **Pentium II processor for the Home** (<http://www.intel.com/home/PentiumII/index.htm>).

Visit Intel's **Create & Share™ Camera Pack web site** and learn how the camera and the PC can be used for fun (<http://www.intel.com/createshare/crshare.htm>).

Intel's **PC Imaging initiative site** with lots of new information including links to Intel's Smart Video Recorder III and Kodak's FlashPix* file format site (<http://www.intel.com/imaging/index.htm>).

Information available on other technologies developing on the consumer platform to support Creativity PCs either now or in the future:

- **USB**—(<http://developer.intel.com/solutions/tech/usb.htm>)
- **1394**—(<http://developer.intel.com/solutions/tech/1394.htm>)
- **AGP**—(<http://developer.intel.com/solutions/tech/agp.htm>)
- **DVD**—(<http://developer.intel.com/solutions/tech/dvd.htm>)
- **Digital Audio**—(<http://developer.intel.com/solutions/tech/audio.htm>)

Platforms: (continued)

Mobile Platforms

What's New

- **Intel Mobile Power Guidelines '99, Final Version 1.0** announced by Intel
(<http://developer.intel.com/design/mobile/intelpower/>)
- **Intel Power Monitor Version 3.0** announced by Intel and available for download
(<http://www.intel.com/mobile/tecforum/sw.htm>)
- Intel **Extends Family Of Mobile Processors** Bringing MMX™ Technology to Mini-Notebooks
(<http://www.intel.com/pressroom/archive/releases/MP102097.HTM>)
- New **Mobile Pentium® Processors with MMX Technology** Provide 40% Increase in Performance and 50% Lower Power Consumption
(<http://developer.intel.com/design/mobile/>)
- Intel Hosts **Fourth Mobile Data Initiative Interoperability Workshop** to Explore GSM/ISDN Interoperability
(<http://www.intel.com/pressroom/archive/releases/WE102497.HTM>)

Overview

Providing Mobile PC users with the flexible environment they require has always been a challenge. IT management challenges include affordability, maintenance, administration, productivity and security. Notebook users need desktop equivalent capabilities in a mobile form factor that's portable. They won't sacrifice performance for mobility, and they need the lowest possible power consumption providing the longest battery life on the road. Users also require seamless communications—over the LAN, the phone line, and through wireless technologies.

Intel is meeting those challenges with its mobile computing vision: anytime, anywhere performance and productivity. Intel is committed to enabling and delivering cost effective, high performance computing solutions that focus on power efficiency, remote manageability, and mobile communications.

Mobile Power Initiative

Intel recently doubled the performance per watt with the introduction of the new mobile Pentium® processor with MMX™ technology at 233MHz. However, as the industry prepares to design systems for 1999—and users continue to demand more features—balancing power, battery life and size is ever more challenging. By designing with the Mobile Power Initiative in mind, it is possible to deliver high-end mobile features without sacrificing reliability and extended battery life.

The **Mobile Power Initiative** (<http://developer.intel.com/solutions/tech/mpi.htm>) is an industry-wide program for mobile PC system manufacturers, component suppliers and software vendors. This comprehensive initiative addresses the industry's power consumption challenges in three major areas: System Hardware, System Software, and Application Software. Intel has made available new high-performance, power efficient microprocessors and other building blocks, new Mobile Power Guidelines (Version 1.0 now available), and a broad array of tools and specifications to support power efficient hardware and software development. The Mobile Power Initiative is supported by a broad array of leading PC system manufacturers, component suppliers and software vendors.

Mobile Manageability

Through the **Wired for Management Initiative** (<http://developer.intel.com/solutions/tech/wfm.htm>), Intel is leading the industry to define and deliver the managed mobile PC. Mobile manageability was added to the WfM Baseline specification in June '97, and Intel is providing mobile instrumentation tools and software to enable mobile OEMs to offer managed mobile PCs.

Mobile computers are only occasionally connected; they have a smaller 'pipe' connection, and they tend to use a variety of dynamically swappable devices. But administrators still need all of the desktop management features, such as software distribution, asset tracking, and remote diagnosis/repair, plus additional features to address unique mobile challenges. Intel's WfM initiative is now addressing these for mobile computers.

By offering mobile manageability solutions—such as tools to enable platform instrumentation, as well as the LANDesk® Client Manager application—we are able to lower the total cost of ownership by providing mobile clients and administrators with reduced downtime and higher productivity than ever before.

Several leading manufacturers are already shipping early versions of mobile managed PCs. These systems provide desktop equivalence while connected to the LAN. Intel will help OEMs to enable more fully instrumented notebook platforms and remote dial-up by the first half of 1998.

Mobile Data Initiative

Formed and led by Intel, the **Mobile Data Initiative** (<http://developer.intel.com/solutions/tech/mdi.htm>) is a cross-industry effort to provide mobile PC users with an easy and affordable wireless connection to data networks, using cellular telephones linked to mobile PCs.

The Mobile Data Initiative unites three exciting technologies. The combination of powerful mobile PCs, digital wireless telephony, and the Internet gives business users new resources that they can leverage while out of the office. With these new products and services, business professionals have fast, reliable and cost-effective access to information wherever their business takes them.

Mobile Power Initiative

What's New:

- **Intel Mobile Power Guidelines '99, Final Version 1.0** announced by Intel (<http://developer.intel.com/design/mobile/intelpower/>)
- **Intel Power Monitor Version 3.0** announced by Intel and available for download (<http://www.intel.com/mobile/tecforum/sw.htm>)
- Industry Status (below)
- Next Steps (below)

Technology Description:

Last month we talked about the introduction of the Intel Mobile Power Initiative on September 17th at the **Intel Mobile Power Symposium** in San Francisco, CA. This is an industry wide program to assist mobile PC system manufacturers, component suppliers and software vendors in delivering future high-end mobile systems and software within mobile thermal limits without sacrificing battery life. This comprehensive initiative addresses the industry's projected design challenges in three major areas: System Hardware, System Software, and Application Software.

Back in September at the Mobile Power Symposium, Intel introduced the Mobile Power Guidelines '99 version 0.80 for industry review and a broad array of tools and specifications to support power efficient hardware and software development. On December 1, 1997, Intel announced the final version of the **Mobile Power Guidelines for 1999 version 1.0** (<http://developer.intel.com/design/mobile/intelpower/>) and the latest version of an application software tool called **Intel Power Monitor Version 3.0** (<http://www.intel.com/mobile/teforum/sw.htm>).

Intel Mobile Power Guidelines '99 Version 1.0

The goal of the Mobile Power Guidelines is to set power targets for mobile components for future mobile platforms and provide advice on how to meet those targets. The key elements include balanced power and performance targets, core and bus voltage roadmaps, and power management recommendations for new mobile technologies, such as IEEE 1394. The Intel Mobile Power Guidelines '99 are supported by leading PC system manufacturers, including IBM*, Toshiba*, Compaq*, Dell* and NEC*, and a broad array of component suppliers and software vendors.

The version 1.0 of the Mobile Power Guidelines '99 added two sections that were not in the version 0.80—display and battery life. The following list summarizes the new additions and changes to the final version of the Mobile Power Guidelines for 1999.

- Display Features and Power Targets
- Battery life
 - Factors and assumptions
 - Total system power estimates
 - Battery life calculations
 - Design considerations
- Other additions/changes to other sections based on industry feedback
 - For example, removal of IEEE 1394 internal device port support in 1999

Intel Mobile Power Monitor Version 3.0

The Intel Power Monitor (IPM), originally introduced in October '96, is a software tool that monitors system activity on Pentium® Processor and Pentium processor with MMX™ technology notebook computers running Windows* 95 and Windows NT 4.0, to provide information about software that may be wasting power. For example, IPM can capture certain command types, such as PeekMessage, that needlessly waste CPU cycles. IPM can then temporarily fix the power-wasting application code in real-time. With the information provided by IPM, Independent Software Vendor's (ISV's) can create power-friendly software.

On December 1st, Intel announced **IPM Version 3.0** and is available today for download. The key new feature in Version 3.0 is the ability to determine hardware device level power. The current devices that can be measured are the central processor and any rotating media such as the hard disk drive, CD-ROM, or floppy drive. If possible in the future, support will be added for other devices on the platform. When estimating device level power, a **Smart Battery** enabled mobile system can allow IPM to more accurately measure power being used by the system.

Benefits to Users:

By implementing the recommendations outlined in the Intel Mobile Power Guidelines '99, the mobile industry should be able to meet the growing user demand for more compelling features and performance while providing reasonable battery life. In 1999, mobile computer users should get more robust systems with high-performance processors, exciting 3D graphics, soft MPEG 2 playback on DVD drives, and new features like the IEEE 1394 I/O bus all within today's mobile thermal limits. Systems designed to the Mobile Power Guidelines '99 should see an increase in battery life from systems designed in 1998.

We all know battery life is important to mobile PC users, and most don't want their software to waste one precious minute of it. In addition to hardware changes in '99, the Intel Application Software Initiative provides guidelines and tools like the Intel Power Monitor Version 3.0 to help software developers create applications that not only perform well, but conserve battery life too. Leading application vendors such as Microsoft*, Lotus* and Corel* have used IPM and seen up to 60% battery life savings while using their popular suites of office applications.

Benefits to Manufacturers:

The desire for new compelling features continues to drive the growth in the mobile industry. The Intel Mobile Power Guidelines '99 provides a comprehensive plan for system manufacturers to add new and compelling features within mobile thermal limits. System and component manufacturers will be able to deliver more innovative, compelling, and reliable systems by utilizing lower power components and lighter-weight thermal solutions. Dell Computer's Doug MacGregor, Vice President, Portables Business Unit, supports the guidelines as he said, "...when these standards emerge, it will give companies all along the development chain the potential to benefit by offering lower cost components that can be more easily integrated into system designs. This should translate into lower cost, more reliable systems which will be a great benefit to Dell's notebook customers."

The benefit the Intel Power Monitor Version 3.0 brings to ISV's is that they can now measure their applications impact on subsystem power. Previously, they could only view total system power. With this new feature, they can tell when their application uses these devices and tune their application for power efficiency. In addition, Independent Hardware Vendors (IHV's) can now use the program to test the impact of applications on their specific device in the system.

Industry Status:

As we mentioned earlier, the Intel Mobile Power Guidelines '99 version .80 was announced at the Intel Mobile Power Symposium in September of 1997. Since then we added two new sections on displays and battery life and a few other edits to make up version 1.0 announced on December 1st, 1997. Throughout the second half of 1998 and into 1999, we expect to see announcements of mobile components and systems that support the recommendations outlined in these guidelines. We will track and recognize these developments and announcements with periodic updates to the Intel Power Initiative developer web site, as well as this Platform Solutions news page. This should help keep the mobile industry informed of the progress of the Intel Mobile Power Initiative as we move towards 1999.

Next Steps:

Please download a copy of the Intel Mobile Power Guidelines Version 1.0 from the Intel Mobile Power Initiative web site.

- Implement the recommendations in your systems and components planned for production in the 1999 time frame.
- Participate in Intel and mobile industry enabling programs for implementation recommendations of key technologies like IEEE 1394.
- Participate in future IMPG development activities
 - IMPG '00 development starts in the second half of '98

Download the **Intel Power Monitor Version 3.0** (<http://www.intel.com/mobile/tecforum/sw.htm>) and utilize this tool along with **Intel's Mobile Application Guidelines** (<http://developer.intel.com/design/mobile/intelpower/>) to develop "mobile friendly" applications.

Continue to provide your Intel Power Initiative input to Power@intel.com.

For more Information:

For more information on the Intel **Mobile Power Guidelines '99** Version 1.0 (<http://developer.intel.com/design/mobile/intelpower/>)

For more information on **Intel Power Monitor Version 3.0** (<http://www.intel.com/mobile/tecforum/sw.htm>)

For more information on the **Smart Battery System**

(<http://www.sbs-forum.org>)

To get more details on Software and the **Mobile Software Guidelines**
(<http://www.intel.com/mobile/tecforum/sw.htm>)

For more details on the **Intel Mobile Power Initiative**
(<http://developer.intel.com/design/mobile/intelpower/>)

For more information on **Mobile System Software and OS power management**
(<http://www.intel.com/mobile/tecforum/os.htm>)

Mobile Data Initiative

What's New:

- Intel Hosts **Fourth MDI Interoperability Workshop** to Explore GSM/ISDN Interoperability
(<http://www.intel.com/pressroom/archive/releases/WE102497.HTM>)
- **North American MDI** Introduced - press release, August 1997
(<http://www.intel.com/pressroom/archive/releases/mp080497.HTM>)
- See who the **North American MDI members** are
(<http://www.pcsdata.com/participants.htm>)
- **History of the MDI**
(<http://www.intel.com/mobile/entrprse/mdi.htm>)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

The Mobile Data Initiative (MDI) is an affiliation of leading technology companies including mobile phone network operators, telecommunications vendors, and mobile PC hardware and software manufacturers. Intel established and leads the MDI with a goal of enabling mobile users to stay connected via a simple, cost-effective wireless connection to data networks.

MDI endorses GSM (Global System for Mobile Communications) technology as the best way to exchange data wirelessly today. GSM is secure, reliable and has the most extensive global coverage of all digital networks. In fact, GSM is used by over 44 million people throughout the world today. PCS1900, an adaptation of the GSM standard for North America, is compatible with GSM networks in Europe and elsewhere around the world. MDI will also endorse other digital wireless telephony technologies as soon as they become business-ready.

Benefits to Users:

Wireless mobile computing completes the business traveler's remote office by making it possible for traveling professionals to stay connected anytime--anywhere their business takes them.

By simply connecting a digital wireless telephone to a notebook computer, business travelers can remotely gain secure access to all of the resources they have while in the office: e-mail, fax, corporate LAN and Internet/intranet. So there's no need to wait for FedEx*, a hotel fax, or even to locate a phone jack; users have immediate access to data and networks wherever they are, and critical information can be relayed on the spot. The downtime that travelers often experience, whether waiting for a flight, in a cab or on a train can now be put to productive use through wireless mobile computing.

Best of all, it's easy. The technology leverages notebook PCs and mobile phones, both powerful tools that business travelers already use. So there's no need to learn to use a new device or to carry extra equipment along--the same phone business travelers use to talk can also be used to transmit data.

Benefits to Manufacturers:

Intel continues to spearhead the Mobile Data Initiative by bringing industry leaders together with a commitment to delivering seamless, integrated solutions. Intel held the first North American "PlugFest" in July 1997 to bring together leading manufacturers of notebook PCs, GSM phones, PCMCIA adapter cards, network data services, and software. Intel will continue to provide interoperability workshops for this community, and actively promotes the development of new products and services.

Intel and the MDI are also working to raise the awareness of this technology and its benefits. These efforts are designed to help spur customer demand for all the components of wireless mobile computing solutions: notebook PCs, wireless phones, PCMCIA adapter cards, access to digital wireless networks and communications software.

Industry Status:

The North American Mobile Data Initiative was launched on August 4, 1997, following a successful European launch earlier in October 1996. The North American MDI currently has 12 core member companies, including the members of the GSM Alliance in the U.S. GSM networks have launched commercial service across the U.S.; voice service is available in nearly half the nation's top 50 metropolitan areas, and data service is coming to most markets soon. GSM networks now serve millions of subscribers worldwide, with a rapidly growing subscriber base in the U.S. Planned coverage will reach virtually the entire U.S. population.

MDI members will continue to introduce products and services that enhance wireless mobile computing throughout 1997 and 1998. Other technologies are currently being evaluated for inclusion in the Mobile Data Initiative.

On October 24 in Lisbon, Intel hosted the fourth Mobile Data Initiative interoperability workshop, focusing on GSM/ISDN interoperability. The workshop tested key elements of the communications link between the notebook PC, the GSM digital network and the ISDN network.

Next Steps:

If you would like more information about the Mobile Data Initiative, or would like to participate in the next "PlugFest" interoperability workshop, please complete a form at one of the following web sites:

In North America, <http://www.pcsdata.com/feedback.cgi.html>

In Europe, <http://gsmdata.com/feedback.cgi.html>

For More Information:

To get more information about the MDI effort, visit the **North American MDI web site** (<http://www.pcsdata.com/>).

Or, the **European MDI web site** is at (<http://gsmdata.com>)

Intel's **Mobile Computing/Wireless Data Communications site** also provides a broader view on wireless mobile computing issues and implementation in the U.S. as well as Europe (<http://www.intel.com/mobile/entrprse/wireles.htm>).

Platforms: (continued)

Server Platforms

What's New

- **Virtual Interface (VI) architecture specification 1.0** released to industry by Intel, Compaq, and Microsoft. New specification sets direction for open, flexible, and highly scalable clustered server solutions.
(<http://www.intel.com/pressroom/archive/releases/sr1216b.htm>)
- Intel Developing Guidelines For **Lean Client And Network Server**; To Support Variety Of Operating Environments. New End-to-End Intel Platform Will Expand Range of Business Computing Systems.
(<http://www.intel.com/pressroom/archive/releases/LC120397.HTM>)
- Don't miss the **Server Platform Technologies track** at the next **Intel Developer's Forum** (Feb. 17-19, 1998). Register Now!
(<http://developer.intel.com/design/idf/>)
- New **I₂O® technology Industry White Paper** available for Download
(<http://www.intel.com/procs/servers/press/aberdeen/body.htm>)
- Intel Announces Availability of New **Hardware Design Guide for Windows NT* Server**
(<http://www.intel.com/pressroom/archive/releases/SP110497.HTM>)
* Download Guide at: (<http://www.intel.com/procs/servers/resource/index.htm>)
- **New 64-Bit Processor** Will Extend the Intel Architecture for Servers—
Joint Intel/HP 64-Bit Instruction Set Disclosed at the Microprocessor Forum
(<http://www.intel.com/pressroom/kits/events/mpf1097.htm>)

Overview:

Intel architecture has been the engine at the heart of industry-standard, high-volume servers since the first i386™ processor-based PC was turned on its side and loaded with Netware®, well over a decade ago. Advances in server platform performance and capabilities since then have primarily been prompted by two fundamental forces: 1) Moore's Law-driven advances in microprocessor performance (please see the feature article in Issue #2 of *Platform Solutions* by **Gordon Moore** based on his keynote address at the Intel Developer Forum) (<http://developer.intel.com/solutions/archive/issue2/feature.htm>), and 2) competition and innovation enabled by widely adopted industry standards.)

No one today would think of installing a server that didn't contain at least one PCI bus. Many server designs include two, three or more PCI buses for maximum bandwidth and throughput. Increasingly, servers are designed with "smart" peripheral controllers that off-load the main processor from low-level I/O chores. Many different approaches to high availability and scalability using various clustering techniques are now starting to be widely used. Finally, storage subsystems are rapidly evolving from the relatively limited realm of SCSI to the practically unlimited environment of Fiber Channel and intelligent, network-attached storage devices.

The result of all of this technological innovation is more performance at a lower price, with freedom from proprietary lock-in as an added bonus. Intel is focused on four main technology areas to further advance the Standard High-Volume (SHV) server platform:

1) scalability, 2) manageability, 3) I/O and 4) flexibility.

Scalability

Ask four IT managers what they mean by “scalability,” and you will get at least four different answers. To Intel, “scalability” means “never being forced to turn away requests for service due to lack of computer system resources.” Intel and the SHV server industry are addressing the scalability challenge in two ways: 1) ongoing, rapid improvements in the performance and throughput of the core electronics complex, including Intel processors and chip sets, and 2) industry-standard, extremely high-performance methods of combining multiple SHV servers together into robust scalability clusters.

The **Virtual Interface (VI) Architecture** is the critical standard that Intel, Compaq*, and Microsoft*, along with over 100 contributor companies, are promoting for high-performance scalability clusters. Robust, high-performance SHV server building blocks, combined with industry-standard, high-performance clustering techniques (and the right kind of cluster-enabled database software), allows the construction of very high-performance and high-capacity server systems that are relatively low-cost when compared to proprietary alternatives.

Regardless of the scale of the workload, such systems will almost never have to turn down a request for service. They will exhibit virtually limitless scalability.

Manageability

As part of its **Wired for Management (WfM) Initiative**

(<http://developer.intel.com/solutions/tech/wfm.htm>), Intel has recently added a server management section to the WfM Baseline Specification. Currently at a 1.1a revision level, Intel is working with leaders in the server management industry to create a 2.0 version of the WfM specification that addresses more of the manageability requirements that are unique to the SHV server platform.

The goal of WfM for servers is to define a broadly accepted and implemented “baseline” level of instrumentation and management features that are available to all management tools written to the baseline. Intel does not expect to include all of the possible aspects of server management in the baseline. Manageability is a critical competitive differentiator for SHV server makers. Intel expects that to continue. The WfM baseline specification for servers merely creates a “starting point” for server management that should be the minimum expectation for any server to be considered “manageable.”

I/O

File and network input/output is the primary thing that servers do, whether the higher-level function they’re performing is database, file/print, Internet, e-mail, etc. Server I/O capacity and throughput are crucial to the overall performance and headroom of the server application. Intel has been working for over a decade to improve server I/O subsystem capacity and throughput. From ISA to EISA to PCI, and on to multiple PCI buses in a single server, Intel provided much of the core technology and enabling silicon products that permitted these improvements.

Intel continues to work to advance the capabilities of the SHV server I/O subsystem. In 1998, SHV servers will be able to accommodate next-generation 64-bit PCI cards. Operating at 33MHz, the 64-bit PCI bus in next year’s server systems will be able to transfer a peak of 266Mbytes per second, twice today’s 133Mbytes. In addition, next year’s servers will provide more PCI expansion slots and more PCI buses than today’s SHV servers can provide. The result is more I/O capacity and greater peak I/O performance, which will be required in order to keep pace with the much higher performance of the core electronics complex.

But raw performance is only part of the story. The overall system I/O architecture is also a critical element. Historically, SHV servers have used monolithic I/O drivers and controllers. These solutions provide good performance for a single card or I/O function, but they deliver that performance at a significant cost in terms of processor and interrupt load. The net result is often less aggregate performance than the system is theoretically capable of providing. So-called “intelligent” network and disk interface cards have also been long available for SHV servers. These cards incorporate a microprocessor and use specialized drivers to off-load a portion of the I/O or networking functions from the main processor. What’s been missing is an **industry standard** that allows every SHV server I/O subsystem to operate in an intelligent fashion.

The **Intelligent I/O (I₂O[®]) Specification** (<http://developer.intel.com/solutions/tech/i20.htm>) provides just such an industry standard. It is targeted at resulting in better overall system performance, scalability and headroom, with the added benefit of reducing the amount of validation work required for new cards and drivers.

Flexibility

Today's SHV servers come in all shapes and sizes. Server vendors configure systems to fit specific purposes according to their market focus. Number of expansion slots and chassis designs vary enormously, among other options. There can never be a one-size-fits-all standard for servers. The range of applications and uses is simply too diverse. However, Intel believes that it is both possible and desirable to create industry standards for selected server modules, such that many different types of final systems can be successfully configured from standards-based building blocks.

Using a common set of building blocks, a system vendor or systems integrator could configure a very large-scale compute server, for example, with many multiprocessing compute nodes in a cluster, and relatively little I/O capacity. A large-scale data-warehouse platform could be constructed from many processor and I/O subsystem building blocks. The common denominators between all of these configurations are industry-standard building-block modules and standards-based, high-performance clustering interconnects.

Expect announcements from Intel and the industry in the near future on standard building-block modules and clustering interconnects.

Virtual Interface (VI) Architecture

What's New:

- **Virtual Interface (VI) architecture specification 1.0** released to industry by Intel, Compaq, and Microsoft. New specification sets direction for open, flexible, and highly scalable clustered server solutions.
(<http://www.intel.com/pressroom/archive/releases/sr1216b.htm>)
- **Oracle and Intel** Announced Development Collaboration focused on IA-64 and VI architecture
(<http://www.intel.com/pressroom/archive/releases/sp062397.htm>)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

Over the last 15 years, high-speed networking hardware has advanced rapidly, with technologies such as ATM, Fast Ethernet and Fiber Channel offering orders-of-magnitude improvements over previous LAN and WAN technologies. On the software side, however, the overhead associated with communicating between the nodes of a large-scale cluster has remained essentially unchanged—until now.

The Virtual Interface (VI) Architecture is an open industry specification designed to facilitate the movement of distributed enterprise applications onto large-scale, high-volume, Distributed Message Passing (DMP) clusters. The VI Architecture defines mechanisms for low-latency, high-bandwidth message-passing between interconnected nodes and interconnect storage devices (e.g. clusters). Low latency and sustained high bandwidth are achieved by avoiding intermediate copies of data and bypassing the operating system when sending and receiving messages. Elimination of this overhead not only enables significant communication performance increases, but also results in a significant increase in the number of CPU cycles available for performing other tasks.

Benefits to Users (IT):

The cluster solutions available today depend on the use of non-standard interfaces, software and often hardware, usually running on one hardware configuration only and using one operating system. There is very little investment preservation as hardware and software technologies evolve. The VI Architecture defines a standard interface that allows distributed clustered applications a single hardware/software interface that results in more portable application code as technology advances occur. This portability allows customers to run their most complex enterprise-class applications on affordable, high-volume, open computing clusters whose high availability-modularity and reliance on industry standards help reduce Total Cost of Ownership (TCO).

Benefits to Manufacturers:

The VI Architecture allows manufacturers to gain a framework for designing and building low-latency, high-reliability clusters for the volume space. The economies achieved through volume manufacturing of these systems allow clusters to be assembled at a fraction of the price, while surpassing mainframes and supercomputers in both performance and reliability. This fosters the growth of economical, innovative implementations, which offer more value to end users.

Industry Status:

The VI Architecture specification version 1.0 has been completed and is **available to the industry for download** (http://www.viarch.org/html/Spec/vi_specification_version_10.htm). The specification was jointly developed by Compaq Computer Corporation*, Intel Corporation and Microsoft Corporation* and reviewed by the server industry prior to completion. Since the original development efforts began in January 1996, more than 100 other industry leaders have joined to endorse the collective endeavor.

Next Steps:

Companies planning to develop VI Architecture based products should download the specification today.

For More Information:

Visit **Intel's Virtual Interface (VI) Architecture information** on the world wide web (<http://www.intel.com/procs/servers/index.htm>). Click on Industry Alliances for Enterprise Computing, then click on Virtual Interface Architecture in the left hand column.

Visit the **VI Architecture industry web site** for more details on contributors, promoters, and press announcements. (<http://www.viarch.org>)

I₂O Technology**What's New:**

- New I₂O[®] **White Paper** by Aberdeen Group Available for Download Today (<http://www.intel.com/procs/servers/press/aberdeen/body.htm>)
- Industry Server Leaders Announce **Intel-based servers with I₂O Technology** (<http://www.intel.com/pressroom/archive/releases/io100797.HTM>)
- Intel's **New I₂O Web Site** Targeted at IT Managers with detailed Information (<http://www.intel.com/procs/servers/i2otech/>)
- Industry Status (see below)
- What's New (see below)

Technology Description:

I₂O[®] technology revolutionizes the concept of intelligent I/O by providing an industry-accepted specification for the development of intelligent I/O solutions. The two primary objectives of the I₂O specification are to improve system-level performance by off-loading the host CPU of I/O tasks, and to

enable the general portability of I/O device drivers across operating systems. The I₂O Architecture is a software specification that provides a standardized framework for the implementation of intelligent I/O subsystems. The concept of intelligent I/O was first introduced in mainframe systems to balance the I/O and compute power of the platform. Special "channel processors" were used to control I/O-specific tasks in these proprietary solutions.

The I₂O specification replaces the standard monolithic device driver with a two-piece driver model composed of the Hardware Device Module (HDM) and the OS Service Module (OSM). The HDM runs on the I/O processor (IOP) and serves as the interface to the target I/O device. The OSM runs on the host processor and serves as the interface to the host operating system. OSMs are developed for each I/O class defined by the specification, and are unique to each operating system. The HDM and OSM communicate over a *messaging layer* using a defined message-passing protocol. This de-couples both the underlying bus or interconnect topology and the HDM of the I/O device from the host OS. For a given device, a single HDM can be developed and used with any OS supporting the I₂O Specification. This model also provides the capability for direct communication between HDMs, thereby laying the foundation for peer-to-peer data transfers. In addition, it allows for stackable drivers, providing the capability to add functionality to standard devices, e.g. adding a third party's RAID firmware to any SCSI device driver.

Benefits to IT Community:

I₂O technology delivers improved system throughput as a result of incorporating an I/O processor that off-loads the host CPU of substantial I/O tasks. In addition, the I₂O technology is an essential part of increasing *scalability* in standard, high-volume (SHV) servers. The ultimate goal of scalable platforms is to provide unlimited ability to expand system resources and still produce proportionally greater performance. Once achieved, a scalable environment is clearly a big win for the IT community.

Another key benefit is the interoperability that I₂O technology provides. The split driver functionality of I₂O technology will simplify the task of integrating systems and managing the complex environments with multiple OSs and I/O technologies that are typically found in an enterprise.

Benefits to Manufacturers:

The I₂O Specification also brings the benefit of accelerating adoption of new I/O technologies, e.g. ATM, Fast Ethernet and Fiber Channel. By reducing the effort required to develop and maintain device drivers, more resources can be applied to I/O innovation. In addition, less time is spent by OEMs and IT departments testing and validating the multitude of peripheral cards and drivers that are certified with any given platform. Once an HDM is validated to communicate properly with the messaging layer, it is then expected to work with all future versions of any OS that complies with the I₂O specification.

Industry Status:

At COMDEX '97 there were 22 vendors showing products and technology based on the I₂O specification. The products included servers, storage adapters, LAN cards, RAID solutions, management software and development tools. Member companies are committed to proliferating the benefits of I₂O technology and are working together to ensure compliance as well as scalability.

Intel and other industry IA server vendors announced products supporting the I₂O specification at the October '97 Network + Interop. The announcements included servers with I₂O technology and Intel i960[®] I/O processors for shipment during the next three months based on Intel Pentium[®] II and Pentium[®] Pro processors. These server systems vendors include: Acer America Corp.*, AST Computer*, Compaq Computer Corp.*, Dell Computer Corp.*, Gateway 2000*, Hewlett-Packard Co.*, IBM Corp.*, Micron Electronics, Inc.*, Mitsubishi Electric PC Division*, NEC Computer Systems Division*, and NCR*.

The development of the I₂O specification is an industry-wide initiative led by the I₂O Special Interest Group (SIG). Originally established in January of 1996 by a group of computer industry vendors (including Intel), it now has an active membership of over 120 companies. For more information on the I₂O Specification, SIG membership, access to the specification, or developments as an industry initiative, visit the **I₂O SIG* web site** (<http://www.i2osig.org/>)

Since the inception of the I₂O SIG in early 1996, membership in the SIG and product announcements have been growing at a significant rate. The industry saw the first demonstrations of I₂O technology at last year's Fall COMDEX. Intel has been playing a major role in the I₂O initiative, providing I₂O technology building blocks. These solutions include highly integrated I/O Processors (featuring an I₂O technology messaging unit, PCI-PCI bridge and embedded CPU based on the i960 processor) and server platforms featuring an Intel IOP and I₂O technology solutions.

Next Steps:

If you're involved in I/O hardware or software development, join the I₂O SIG and start investing in the technology that your customers will require. The I₂O Specification is available through the I₂O SIG web site, which also provides information on how to become a SIG member and gain access to the ongoing forums that provide invaluable guidance for your product development decisions.

If you are an IT manager or system administrator, familiarize yourself and your team with the concepts of the I₂O technology and consult with your equipment providers about how they plan to implement I₂O technology solutions in their coming products. The vendors who announced products at the October '97 Network + Interop will be shipping products by January '98 (see **press release** <http://www.intel.com/pressroom/archive/releases/io100797.HTM>). The I₂O SIG web site also contains interesting content for non-developers, including vendor announcements, SIG events and industry developments.

For more information:

Visit **Intel's New I₂O web site** targeted at IT managers with detailed information on I₂O technology (<http://www.intel.com/procs/servers/i2otech/>).

Visit **Intel's Intelligent I/O Processor web site** for developers including information on Intel's i960 RP I/O processor (<http://www.intel.com/design/iio/>).

Visit the **I₂O Industry SIG web site** (<http://www.i2osig.org/>).

Platforms: (continued)

Workstation Platforms

What's New

- **New 64-Bit Processor** Will Extend the Intel Architecture for Workstations—
Joint Intel/HP 64-Bit Instruction Set Disclosed at the Microprocessor Forum
(<http://www.intel.com/pressroom/kits/events/mpf1097.htm>)

Overview

Workstations based on Intel microprocessors have been very competitive at the entry level of the workstation marketplace. They are now demonstrating their power in the midrange and beyond with the **Pentium® II processor** (<http://www.intel.com/businesscomputing/wrkstn/PentiumII/index.htm>) and **Pentium® Pro** (<http://www.intel.com/procs/ppro/wrkstn/index.htm>) microprocessor. That's good news for any company that wants great workstation performance and open system architecture benefits at a fraction of the cost of traditional workstation systems.

Workstation users demand levels of performance that, until recently, could be delivered only by vendors competing on the basis of proprietary, vertically integrated solution "stacks" with little cross-vendor compatibility. Now, that situation is changing. A generation of workstations built around either single or multiple Intel Pentium II or Pentium Pro processors extends the value economics of the PC industry into workstations.

Intel has assembled a team of workstation experts in its new Workstation Products Division (WPD) to supply building blocks, technologies and programs to OEMs, IHVs and software developers to accelerate the development of the Intel architecture workstation market. **System vendors** (http://www.intel.com/procs/ppro/wrkstn/wks_sys.htm) and applications providers alike have been quick to embrace the Pentium II processor's computational muscle and the maturity of Windows NT* for workstation use.

Standard Architecture

The biggest benefit of a single architecture that scales from personal computers to workstations is maximum access to the innovations in both. For users, the new workstation industry provides high-performance with outstanding price/performance. It also contributes significantly to lowering the total cost of ownership (TCO) of workstation computing. In essence, more space and convenience to engineering, lower cost-per-resource to management, lower support costs, and less need for duplicate equipment.

High-Performance

At the heart of the new workstation architecture is Intel's Pentium II processor introduced in May 1997. The Pentium II processor, currently available in frequencies up to 300MHz, delivers the performance required for workstation applications. (For **performance info** please visit <http://www.intel.com/businesscomputing/wrkstn/PentiumII/perf/>)

Over the coming months you will continue to see exciting announcements in the area of workstation advancements based on the Intel architecture. These systems will possess all the key features you have come to expect from an engineering workstation, at an incredible price point:

- High-performance CPU
- Sophisticated 3-D graphics subsystems
- Built-in scalability
- Fast, highly expandable I/O, including advanced networking support
- Configurability to support hundreds of megabytes of RAM and terabytes of disk storage

At the October '97 Microprocessor Forum, Intel announced that the first member of its new family of 64-bit microprocessors, code named Merced™, is scheduled for production in 1999.

The processor, still under development, will extend the Intel Architecture with new levels of performance and features for servers and workstations. In addition, Merced processors will run all the software that currently operates on 32-bit Intel processor-based workstations. For more information on IA-64 and Merced, please visit the **Intel Microprocessor Forum site** (<http://www.intel.com/pressroom/kits/events/mpf1097.htm>).

Complete Solutions

A successful workstation is much more than a powerful processor. Intel is committed to continue working with other companies throughout the industry to ensure that all the technologies and products are in place to deliver optimal workstation solutions based on the Intel architecture.

For more information about **Intel Architecture based workstations**, please visit Intel's Workstation web site (<http://www.intel.com/businesscomputing/wrkstn/index.htm>).

Technologies:

Microprocessor Technology

What's New:

- New Pentium® II Processor **Developers Manual** Now Available
(<http://developer.intel.com/design/PentiumII/manuals/243502.htm>)
- Intel Identifies **Workaround** for the "Invalid Operand with Locked Compare Exchange 8Byte (CMPXCHG8B) Instruction" Erratum on the Pentium Processor
(<http://support.intel.com/support/processors/pentium/ppiie/index.htm>)
- Intel **Extends Family Of Mobile Processors** Bringing MMX™ Technology to Mini-Notebooks
(<http://www.intel.com/pressroom/archive/releases/MP102097.HTM>)
- **New 64-Bit Processor** Will Extend the Intel Architecture—
Joint Intel/HP 64-Bit Instruction Set Disclosed at the Microprocessor Forum
(<http://www.intel.com/pressroom/kits/events/mpf1097.htm>)
- **Pentium II Processors** Now Available for Business, Workstation, Consumer, and Server Platforms
(<http://www.intel.com/pentiumII/home.htm>)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

The Pentium II processor is the most advanced Intel Architecture processor with Intel MMX technology. Delivering Intel's highest performance on the three vectors of computing—floating point, integer, and multimedia—the Pentium® II processor provides ample processing power needed in today's operating systems and applications such as business media, PC imaging, communications, and gaming.

The Pentium II processor is available in 233MHz, 266MHz and 300MHz versions for desktops, workstations and servers. The processor uses the high-performance Dual Independent Bus (DIB) architecture to deliver greater system bandwidth to complement its high processing power. The Single Edge Contact (S.E.C.) cartridge design includes a dedicated 512KB level two (L2) cache. The Pentium II processor also includes 32KB of level one (L1) cache (16K data, 16K instruction), twice that of the Pentium Pro processor. Error Correction Code (ECC) memory is now available on the L2 cache. If enabled, this type of cache better enables servers and workstations to operate in business environments where data integrity and reliability are essential.

For more information visit the **Pentium II processor** home page (<http://www.intel.com/PentiumII/home.htm>). Or, for more detailed information please see the Pentium II processor **Technical Fact Sheet** (<http://www.intel.com/pressroom/archive/releases/dp5797fs.htm>).

Benefits to Users:

Together, systems designed with the Pentium II processor and the **Accelerated Graphics Port (AGP)** (<http://developer.intel.com/solutions/tech/agg.htm>) make multimedia software come alive. Greater processing power and video bandwidth allows for better 3D graphics, richer textures, higher resolution, and smoother animation than ever before. All this allows for a more lifelike experience for games, educational and hobby software. The Pentium II processor also enables new capabilities in PC imaging, video editing and playback, and audio re-mixing. Improved video performance means crisper and clearer images during video playback and editing. Pentium II processor-based systems bring home rich and

exciting PC entertainment experiences with new media technologies like host-based **DVD** (<http://developer.intel.com/solutions/tech/dvd.htm>).

In business, Pentium II processor systems are available for desktop, server and workstation platforms. The Pentium II processor family is fully compatible with previous generations of Intel Architecture processors. Both small and large businesses benefit from optimal performance with applications running on advanced operating systems such as Windows* 95, Windows NT* and UNIX*.

On top of its Dynamic Execution and DIB architecture, the Pentium II processor has been designed to take full advantage of software designed for Intel's MMX technology. This technology enhances full-motion video playback, color depth, and provides increased realism in 3D and graphics images, plus offers other media enhancements.

At the October '97 Microprocessor Forum, Intel announced that the first member of its new family of 64-bit microprocessors, code named Merced™, is scheduled for production in 1999. The processor will be produced on Intel's 0.18 micron process technology, which is currently under development. The Merced processor will extend the Intel Architecture with new levels of performance and features for servers and workstations. Merced processors will run all the software that currently operates on 32-bit Intel processor-based machines. As IA-64 becomes established with the Merced processor, Intel will continue to expand its 32-bit product offerings. Larger cache memories, faster buses and continuing increases in core frequencies are among the features of the planned additions to today's Pentium II processor family slated for release in mid '98. In 1999, Intel's product offerings will span from 32-bit products for office, home and mobile users to the most powerful 64-bit products which will move Intel into new, higher-end workstations and server market segments. For more information on IA-64 and Merced, please visit **the Intel Microprocessor Forum site** (<http://www.intel.com/pressroom/kits/events/mpf1097.htm>).

Benefits to Manufacturers:

Whether you're developing today's most advanced hardware platforms or leading-edge multimedia software, Intel's Pentium II processor brings you Intel's highest performance processor to date allowing you to offer increased performance and capability to business and consumer users. To help you get your own products to market as quickly and reliably as possible, the **Pentium II Processor Developers' web site** (<http://developer.intel.com/design/PentiumII>) offers up-to-the-minute technical information—from product and platform specifications, tools, design guidelines, technology tutorials, related products, and programming and manufacturing support. Check back often for new design information.

Industry Status:

The Pentium II processor family supports the evolution of the PC platform in four important ways:

- 1) Dual Independent Bus architecture
- 2) Dynamic Execution
- 3) Intel MMX technology
- 4) Single Edge Contact (S.E.C.) cartridge

These technologies are bringing enhanced performance and capabilities to make visual computing possible on PCs today. Platforms for the business, consumer, workstation, and server market segments are all shipping today. Intel will continue to bring higher performing 32-bit microprocessors and complementary platform building blocks to enhance visual computing capabilities in the future.

Intel's new family of 64-bit microprocessors, code named Merced™, scheduled for production in 1999, will bring new levels of performance and features to new, higher-end server and workstation market segments while continuing to be fully compatible with today's applications running on the 32-bit Intel Architecture.

Next Steps:

Developers - Base your next PC design on the Pentium II processor. Whether it is a business desktop, workstation, consumer desktop, or server platform, the Pentium II processor is currently Intel's most advanced processor in volume production.

For More Information:

Pentium II processor home page

(<http://www.intel.com/PentiumII/home.htm>).

Pentium II processor developer information

(<http://developer.intel.com/design/PentiumII/>).

Dual Independent Bus (DIB) Architecture

(<http://www.intel.com/pentiumII/SPECS/dib.htm>).

MMX technology

(<http://www.intel.com/pentiumII/SPECS/mmx.htm>).

Dynamic Execution

(<http://www.intel.com/pentiumII/SPECS/dynamic.htm>).

S.E.C. cartridge packaging

(<http://www.intel.com/pentiumII/SPECS/sec.htm>).

Pentium II processor performance

(<http://www.intel.com/procs/perf/PentiumII/index.htm>).

Pentium II processor platform technologies

(<http://developer.intel.com/design/pentiumii/platform/index.htm>).

Intel's IA-64 and Merced information from Microprocessor Forum

(<http://www.intel.com/pressroom/kits/events/mpf1097.htm>).

Memory Technology

What's New:

- Intel Updates **100MHz SDRAM Specification** to Version 1.51 Available Today (<http://developer.intel.com/design/pcisets/memory/index.htm>)
- “**High Performance Memory Implementations**” technical track at the next **Intel Developer Forum in February 1998**. Register before January 16 and save \$200. (<http://developer.intel.com/design/idf>)
- **Rambus Details Next-Generation**, High-Speed Memory Interface Targeted at Main Memory, Consumer Electronics and Communications Systems. Direct Rambus* Technology Sustains 1.5 Gbytes/sec per Device and Support Multiple DRAM Densities. (http://www.rambus.com/html/oct_15__1997.html)
- At the Intel Developer Forum on September 30, **Rambus announced industry support** for Direct DRAM technology in 1999 and Introduced its New RIMM* Memory Module Package (http://www.rambus.com/html/sep_30__1997.html)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

Intel's goal is to ensure that memory subsystems continue to support evolving platform requirements through 1998 and beyond. Mainstream memory bandwidth requirements will be satisfied by EDO and 66MHz SDRAM performance through the first half of 1998. Intel is also working with memory vendors to keep up with the performance of faster processors and bus architectures. For the past 12 months, Intel has worked with leading DRAM vendors to anticipate this need by developing 100MHz PC SDRAM Component and DIMM specifications. In the second half of 1998, the industry will see an adoption of 100MHz SDRAM to complement new, faster Pentium® II processors. Beginning in 1999, the PC platform will be enhanced by Direct RDRAM to further enhance the interactive lifelike visual experiences on the standard PC platform, including workstation-quality 3D graphics and consumer-quality video.

Benefits to Users:

The emergence of 3D and video applications and the evolution of the **PC platform to the Visual Connected PC** (<http://developer.intel.com/solutions/archive/issue1/focus.htm>) keeps evolving the PC architecture. New PC designs that will be based on faster Pentium II processors in mid-'98 are driving the need for ever-higher system memory bandwidth. Intel's leadership and industry participation are delivering new memory technologies which enable the development of higher performance PCs.

Benefits to PC Manufacturers:

Continuous work on PC SDRAM specifications helps PC manufacturers showcase platform performance and meet development targets for cost, availability and high-performance features. By working with the industry to develop PC SDRAM and DIMM specifications, Intel is helping to assure that memory products are built to support the next generation of platform requirements. Industry-wide compatibility helps PC OEMs line up multiple compatible DRAM suppliers to meet their cost and availability targets, while providing a high-quality product to PC end users.

Industry Status:

Intel's goal is to ensure that memory subsystems continue to support evolving platform requirements and to assure that memory does not become a bottleneck to system performance. It is especially important to assure that the PC memory roadmap evolves together with the performance roadmaps for the processors, I/O and graphics. To meet this goal, Intel has worked for the past 12 months with leading DRAM vendors to develop 100MHz PC SDRAM Component and DIMM specifications that are **now**

available on Intel's developer web site (<http://developer.intel.com/design/pcisets/memory/index.htm>). In addition, Intel participates in ongoing industry dialog to assure that memory suppliers get their technical questions answered.

Intel's role is to work with the memory industry to project future requirements, evaluate technology options, to help choose a path with adequate lead time and then to facilitate communication leading to a complete platform memory solution. This process achieved solid results beginning in 1994, with the introduction of PBSRAM technology for L2 cache. In 1994–1995, EDO DRAM was supported by the Intel 430FX PCIsset to achieve major performance improvements on the Pentium® processor. In 1996, the Intel 430VX PCIsset supported 66MHz EDO and SDRAM. Intel's newest chip set, the **Intel 440LX AGPset** (<http://developer.intel.com/design/agpsets/440/index.htm>), supports current platform requirements with 66MHz SDRAM. Intel continues to support the memory industry with system-level simulation tools and design capability to assure OEMs and users have the right products at the right time.

On September 29, Intel held the first Intel Developer Forum focusing on the tools and technical training necessary to implement the latest technologies. Intel provided a memory technologies track where its top architects discussed 100MHz SDRAM platform implementations for 1998, and Rambus was on hand to discuss Direct RDRAM for 1999. Register for the **February Intel Developer Forum** (<http://developer.intel.com/design/idf>) by January 16 and save \$200. There will be a memory track on "High Performance Memory Implementations".

Next steps:

Intel has delivered the PC SDRAM Component Specification, as well as the Serial Presence Detect and 100MHz DIMM specifications to major vendors and OEMs. These specifications are now available, and were updated in November 1997, on the Intel developer web site. They provide all the information needed to develop memory modules to support the latest Intel platforms through 1998.

The next step in the memory roadmap is Direct RDRAM. Intel and Rambus are working together to extend Rambus technology to meet PC platform memory requirements for 1999 and beyond.. On October 15, 1997 Rambus announced the details of its next-generation, high-speed memory interface. Developed in conjunction with Intel and in cooperation with other Rambus semiconductor partners, Direct Rambus technology is gaining broad industry support. More than a dozen DRAM companies, including the world's top 10 DRAM makers, have announced their intention to develop Direct RDRAM products. And in September, 18 companies representing the leaders in system-memory implementation products--including memory modules, connectors, clock chips and test systems--announced their intention to support Direct Rambus technology. Planned applications include computer system memory, multimedia and graphics memory, communications system memory and consumer electronics memory. For more details on the Rambus announcement please visit the **Rambus press release** (http://www.rambus.com/html/oct_15__1997.html).

Don't miss the "High Performance Memory Implementations" technical track at the **February Intel Developer Forum** (<http://developer.intel.com/design/idf>). Register before January 16 and save \$200 off the registration price. Intel and industry developers will be on hand with the latest details on next generation memory implementations.

For more information:

Revisit this page often for the latest details on Intel platform support services and future information on Direct RDRAM.

AGP Technology

What's new

- AGP Interface **Specification, Revision 2.0** (preliminary draft) Now Available
(<http://www.intel.com/pc-supply/platform/agfxport/index.htm>)
- Register for the **February Intel Developer Forum (IDF)** prior to JANUARY 16 and **save \$200**
Two Different Graphics Technical Tracks will be provided:
 - *AGP 4X: Next Generation Graphics*
* *Understanding 3D Graphics and AGP Performance*
(<http://developer.intel.com/design/idf>)
- Intel's Director of Chip Set Engineering, Richard Malinowski, describes "**AGP Done Right**" in this issue of Platform Solutions newsletter
(<http://developer.intel.com/solutions/issue/stories/top1.htm>)
- Third **AGP Plugfest Coming** in February—Register Now!
(<http://www.agpforum.org>)
- Intel Announces **IPEAK Family of Performance Analysis Tools**, including a tool for Graphics and AGP Performance Analysis
(<http://developer.intel.com/design/ipeak/>)
- Visit Intel's **AGP web site** for in-depth information
(<http://developer.intel.com/technology/agp/index.htm>)
- Industry Status (below)
- Next Steps (below)

Technology description

The Accelerated Graphics Port (AGP) is a dedicated interface on the PC platform that enables high-performance graphics and full-motion video on mainstream PCs. The AGP interface, positioned between the PC's chip set and graphics controller, significantly increases the bandwidth available to a graphics accelerator (current peak bandwidth of 528 MB/s). It also helps to alleviate the cost pressure associated with a growing need for large and expensive dedicated graphics memories by leveraging a PC's main memory, in addition to local graphics memory.

By leveraging main memory, Independent Software Vendors (ISVs) are no longer constrained by the amount of dedicated local graphics memory in limiting the visual quality of their applications. Using main memory as if it were an extension of the dedicated local graphics memory, ISVs have significantly more storage space available for graphics data, which permits a significant increase in visual quality. Not only does AGP improve 3D graphics, but its increased bandwidth is a key enabler for full-motion video on the PC, such as host-based software MPEG-2 playback (DVD).

AGP lays a scalable foundation for high-performance graphics—future systems will support an AGP peak bandwidth over 1GB/s. An AGP enabled system requires an AGP-compatible: graphics accelerator chip or add-in card, chip set, BIOS, and motherboard. The AGP specification, which has been led by Intel and made available to the industry, is a key building block for Intel's **Visual Computing Initiative** (<http://developer.intel.com/solutions/archive/issue1/focus.htm>).

Benefits to users

Merely delivering an AGP compatible product in a PC is not good enough to meet the demands of today's savvy PC purchasers. Enabling high-performance graphics for developers, as well as for PC users, requires significant planning to eliminate "weak links" in other parts of a PC system. With the Pentium® II processor and its Dual Independent Bus (DIB) architecture, Intel has proactively taken steps to "raise the bar" in terms of performance for other parts of the PC system. First, the extremely powerful floating-point performance of the Pentium II processor is the foundation for high-performance graphics. This permits ISVs to develop a new class of applications that can deliver life-like experiences to PC users. Second, the Pentium II processor's integrated L2 cache within the Single Edge Contact Cartridge permits the L2 cache frequency and performance to scale with the higher frequency CPUs that Intel will be delivering throughout 1998. A significant weakness of a Socket-7 AGP implementation is that the L2 cache performance does not scale with the CPU. Third, the DIB architecture allows the Pentium II processor to be performing 3D calculations while at the same time an AGP graphics accelerator can be performing AGP Texturing (i.e., directly executing textures from main memory). Doing this work in parallel is in part delivered by **Intel's 440LX AGPset**

(<http://developer.intel.com/design/agpsets/440/index.htm>), which can be found in today's Pentium II processor based systems at mainstream price points. Again, the lack of this concurrency is another weakness of a Socket-7 AGP implementation.

Some of the first applications optimized for AGP are beginning to show up on store shelves. For example, Psygnosis' G-Police, a flight simulation title that is set in a Bladerunner-like future, is now available. The AGP-enabled version of G-Police provides richer backgrounds, more spectacular special effects, and even uses full-motion video textures on city billboards within the application.

In addition to arcade-quality 3D games, consumers can expect entirely new classes of applications to be enabled by AGP, such as 3D reference works and interactive video titles. Business users will also see new types of applications resulting from AGP, such as 3D visualization and interactive 3D web applications.

Here is just a sample of some applications that are being optimized to take advantage of the benefits of AGP. Some of these applications have already started showing up on store shelves, and others will arrive in early 1998 and throughout the year. (A few of these applications are still in early development):

<u>Application</u>	<u>Developer</u>	<u>Publisher</u>	<u>Category</u>
G-Police	Psygnosis	Psygnosis	Flight simulation
Red Line Racer	Criterion Studios	Ubi Soft Entertainment	Motorcycle racing
Tonic Trouble	Ubi Soft Entertainment	Ubi Soft Entertainment	Kids action/adventure
Eyewitness Virtual	DK Multimedia	DK Multimedia	Education/refer—DVD
O-Zone	Pixel	Electronic Arts	Online action game
F22: Air Dominance	Digital Image Design	Ocean-Infogames	Flight simulation
Beyond the 3 rd Dimen.	Davidson and Assoc.	CUC	Kids education/game
Tex Murphy: Overseer	Access Software	Access Software	Detective game—DVD
ConceptCAD	Virtus Corporation	Virtus Corporation	3D Visualization

Here are some Internet URLs for some of the AGP software developers listed above:

Psygnosis = www.psygnosis.com
 Criterion Studios = www.csl.com
 Ubi Soft Entertainment = www.ubisoft.com
 Pixel = www.pixelmm.com
 Electronic Arts = www.ea.com
 Digital Image Design = www.did.com
 DK Multimedia = www.dk.com
 Access Software = www.accesssoftware.com
 Davidson and Associates = www.davd.com
 Virtus Corporation = www.virtus.com

Benefits to manufacturers

One of the benefits of Intel re-doubling its efforts to deliver Pentium II processors to meet the needs of PC OEMs and the marketplace in general, is that AGP will find its way into systems priced very aggressively in the second half of '98. In fact, it is anticipated that a Pentium II processor system with AGP will be part of the Basic Desktop PC in the second half of '98. This eliminates the short-term cost benefits others thought might exist for a Socket-7 AGP implementation. Also note that Intel has designed and delivered a software patch (AGP VxD) to support all of the AGP benefits on Windows* 95—you can deliver all of the AGP benefits for your customers today. Finally, taking graphics off of PCI and putting it on AGP does not address the other weaknesses of a Socket-7 AGP implementation; that is, it still does not address the L2 cache inefficiencies or the bottleneck in getting to main memory. In fact, if one starts storing texture maps in main memory (which is one of the cost savings benefits of AGP) on a Socket-7 AGP implementation, it may make the main memory bottleneck even worse.

AGP takes PCs to a new level of performance. Exciting arcade-quality games and new classes of applications promise to grow the overall market for PCs, peripherals, and Software. By providing a dedicated, high-speed connection between the graphics controller and main memory that matches the processing power of the Pentium II processor, AGP balances the overall performance of the Intel Architecture PC platform. PC OEMs can build systems that more fully realize the potential of the Pentium II processor, and graphics Independent Hardware Vendors (IHVs) can build products that are no longer constrained by the limited bandwidth of the PCI bus. AGP is a scalable solution designed so that graphics performance will improve with performance increases of the Pentium II processor.

Industry status

The *Preliminary Draft of the Accelerated Graphics Port Interface Specification Rev. 2.0* is now available on the internet (<http://www.intel.com/pc-supply/platform/agfxport/index.htm>). This specification includes the AGP 4X enhancements, in addition to incorporating the Engineering Change Requests (ECRs) from the earlier Rev. 1.0 specification.

At the next **Intel Developer Forum (IDF)** in February, Intel will be devoting one of the technical tracks to AGP 4X (*Track Title—AGP 4X: Next Generation Graphics*). This track will provide an overview of the AGP 2.0 specification including the thought processes that led to some of the developments and details of changes from the AGP 1.0 specification. Sessions during the day will discuss AGP 4X logic and electrical considerations, technology capabilities and implementation alternatives, packaging and board requirements for 4 and 6 layer designs, and AGP upgradability. There will be a separate track titled *Understanding 3D Graphics and AGP Performance*. Both of these tracks are an invaluable opportunity to learn from and meet some of Intel's architects and engineers that are doing excellent work in and around 3D graphics and AGP. If you register before January 16, 1998, you can save \$200 off the full registration price (for details please visit the **IDF web site**—<http://developer.intel.com/design/idf>).

Intel continues with the development of its **Intel Performance and Evaluation Kit (IPEAK) tools** for graphics. The intent of these tools is to provide a very useful family of platform performance and integration tools to the industry to enable development of higher performance and more robust products with a quicker time-to-market. Although the final tools are targeted to be available in Q1'98, you can join the beta program today. The IPEAK Graphics Toolkit currently consists of two tools that help OEMs and IHVs analyze and improve the performance of their graphics solutions. First, The Graphics Performance Toolkit provides a better understanding of the performance issues and limitations related to graphics hardware and applications. Second, the Baseline AGP System Evaluation Suite is a system integration and validation tool that provides the capability to test and evaluate AGP system-level functionality and utilization. (For further details please visit the **IPEAK web site** -- <http://developer.intel.com/design/ipeak/>).

You are invited to attend the **AGP Plugfest** in Milpitas, California, February 10–13, 1998. Due to the great attendance at the last AGP Plugfest in Taiwan, the testing schedule has been extended. The Plugfest is an interoperability event intended to bring together manufacturers of AGP graphics controllers, graphics cards, motherboards and system OEMs to test card and system compatibility. The Plugfest includes several training sessions to explain test methodology and highlight what's new with

AGP. Testing sessions are private, one hour per OEM. The tests are designed to validate hardware and software functionality in a noncompetitive environment. Additional test teams will be available to validate electrical and mechanical specs and BIOS settings. A suite will be available for on-site debugging. For more information about the Plugfest, including AGP Implementors' Forum Membership, registration and hotel information, please visit the **AGP IF web site** (<http://www.agpforum.org>). Please note that you must be a member of the AGP Implementors' Forum to attend. You must register by January 19, 1998.

Next steps

PC OEMs—When delivering high-performance PCs to your customers be sure to choose the Intel Pentium II processor and the Intel 440LX AGPset. This powerful combination will provide the necessary horsepower to meet your customers' expectations for high-performance graphics (e.g., extremely powerful floating-point performance, DIB, etc.).

Graphics Chip and Card Vendors—Design your second-generation AGP products to support the high-performance AGP features (e.g., SideBand Addressing, Pipelining, AGP 2X, etc.). Be sure to proactively design in support for AGP Texturing, in addition to Local Texturing.

Software Developers—Now is the time to develop exciting new applications that take advantage of AGP technology. Create applications with rich, lifelike textures to take advantage of the many AGP enabled PC systems and cards entering the market in the second half of '97 and throughout 1998. Take advantage of the AGP capability to use main memory as an extension to the local graphics memory (i.e., AGP Texturing).

For More Information

Visit Intel's AGP web site to **download** the *Preliminary Draft of the Accelerated Graphics Port Interface Specification Rev. 2.0*, which includes the AGP 4X enhancements. (<http://www.intel.com/pc-supply/platform/agfxport/index.htm>)

Visit Intel's **AGP home page** for more detailed information on AGP and a tutorial explaining AGP functionality at the system level. (<http://developer.intel.com/technology/agp/index.htm>)

Visit the **AGP Implementors Forum home page** for more development, product, and event information, including registration details for the next AGP Plugfest and helpful design guides. (<http://www.agpforum.org>)

Visit **IPEAK web site** for more information on Intel's IPEAK Graphics Toolkit. Join the beta program today, with final tools targeted for the first quarter in '98. (<http://developer.intel.com/design/ipeak/>)

DVD Technology

What's New:

- New White Paper Available - **DVD Video Playback Primer**
(<http://developer.intel.com/solutions/tech/dvd/dvdrp10.pdf>)
- **Successful DVD Developer Conference.** Intel and the Software Publishers Association hosted a conference on October 29th that provided development guidelines, tools and solutions for the industry to bring more compatible DVD Interactive titles to PCs
(<http://www.intel.com/pressroom/archive/releases/IV102997.HTM>)
- Download the **new DVD white papers** provided at the DVD Developer Conference:
(<http://developer.intel.com/solutions/tech/dvd.htm>)
 - * **MCI recommended command set** for DVD title development under Windows* 95
 - * **DVD interactivity white paper** showing transition of MCI commands to DirectShow*
- Read the top story in Issue #3 of *Platform Solutions* on "**Host-based DVD: Arriving on PC Platforms Today,**" by Rajesh Shakkarwar, Intel's DVD Technology Development Manager
(<http://developer.intel.com/solutions/archive/issue3/stories/top5.htm>)
- Download the **DVD white papers** provided at the Intel Developer Forum on September 29:
(<http://developer.intel.com/solutions/tech/dvd.htm>)
 - * Copy Protection Licensing Requirements for the **CSS DVD Method**
 - * **Tamper Resistant Software: An Implementation**
 - * Implementation of a **High-Quality Dolby* Digital Decoder** Using MMX™Technology
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

DVD is a new optical storage technology that stores digital information on discs which are similar in size and appearance to CD-ROMs. DVD discs can contain a combination of audio, video, and computer data, and have been designed for use in both the home entertainment and PC environments. By using 50% smaller "pits" to hold data, a DVD disc can currently hold seven times as much information as a conventional CD-ROM. Future DVD discs will be double sided and double layered, allowing four times again as much data to be stored (up to 17GB).

DVD technology has been under development for several years, and five different variations have arisen to meet the needs of different types of users:

- **DVD-Video**—Read-only storage intended for the playback of entertainment content, such as movies, on consumer DVD players connected to a TV or on DVD drives in a PC.
- **DVD-ROM**—Read-only storage intended for PCs. Essentially a much larger CD-ROM. Can store video, audio, images and graphics in any format. Ideal for interactive software such as games, reference materials and other data intensive applications.
- **DVD-R (Recordable)** - Write-once, read-many storage. The target usage model includes archiving, software development and low-volume data distribution.
- **DVD-RAM**—Write many, read many storage. Example applications include short-term archiving, software development and media recording.
- **DVD-Audio**—This format focuses on music and other forms of audio-only content. A number of technical issues remain to be resolved, including encoding and copy protection.

Consumer electronics companies are currently producing DVD-Video players to be used primarily for playing movies on televisions. PC-based DVD playback, however, can support all of the DVD formats

ushering in a broader array of applications, including interactive titles, archiving and movies. PC DVD drives are also backwards compatible and will play existing CD-ROM titles and CD audio recordings.

DVD-ROM titles for the PC can be encoded in a variety of different formats (e.g., Indeo® video, MPEG1, MPEG2, Cinepak*), whereas DVD-Video titles for home entertainment are generally restricted to MPEG2 video and AC-3 or Linear PCM audio. The range of encoding formats on PC DVD lends itself to flexible solutions which perform decoding in software rather than with dedicated hardware. PCs based on Intel's Pentium® II processor are especially well-suited for software, or host-based, playback of DVD content utilizing the power of the microprocessor instead of costly add-in hardware.

Due to the ease with which digital content can be replicated, copy protection has been an important issue in the development of DVD technology. Intel has worked closely with Hollywood studios and the electronics industry to define copy protection solutions that are suitable for both the consumer electronics and PC industry. Intel has made available a copy protection CSS white paper at the top of this page.

Benefits To Users:

DVD promises to offer consumers a new level of **visual computing**

(<http://developer.intel.com/solutions/archive/issue1/focus.htm>) experience on their PCs. Users can come to expect the following benefits from DVD technology:

- *Huge storage capacity* - Today's applications requiring multiple CD-ROMs (e.g., *WingCommander II**) can be consolidated onto a single DVD-ROM disc.
- *Incredible quality* - With DVD, consumers will be able to experience theater-quality video and audio on their PC.
- *Rich interactivity* - The large capacity of DVDs combined with the processing power of the PC will enable software vendors to create applications that provide visually rich, interactive experiences for end-users.
- *Convergence* - DVD video discs will play on both set-top players and PCs.
- *Backward compatibility* - DVD drives can play existing audio CDs and CD-ROMs.

Benefits To Manufacturers:

DVD technology promises to benefit a wide array of industries and companies. PC OEMs will be able to deliver a more interactive and media-rich experience to end users. Solutions that use both dedicated hardware for playback, as well as host-based software playback, on PCs are already available today. Software providers will be able to create new titles that integrate full-motion video, high-quality audio, graphics and images. In the near term, they can consolidate multi-CD titles onto a single DVD. Drive manufacturers stand to see increased business as the momentum behind DVD builds and sales of PC DVD drives explode. CD drive and disc manufacturers can leverage their existing manufacturing technology to make DVD products.

Industry Status:

All major consumer electronics companies have released or announced DVD-Video players. Moreover, most major Hollywood studios support the medium and have begun releasing movies on DVD. At least 150 titles are shipping today and over 350 titles are expected by the end of 1997. In the PC market, the first DVD-ROM drives for computers began shipping in April of this year. PC OEMs are integrating DVD drives into their product lines today. Higher-end solutions will rely on hardware solutions for de-scrambling and decoding functions, but a few OEMs have already announced host-based solutions that utilize the Pentium II processor. The more cost-effective host-based DVD playback solution on Pentium II processor-based platforms will allow DVD on the PC to reach mainstream price points by the second half of 1998. In addition, the software industry is making a concerted move to DVD-ROM, with over 50 interactive titles expected by the end of 1997. The DVD-R and DVD-RAM specifications are complete but products are not yet available. Recently, several companies (Sony*, Phillips*, and Hewlett-Packard*) have announced an alternative format to DVD-RAM called DVD+RW. The DVD-Audio specification is still under development and products are not expected until 1999.

Intel has been working with the PC and consumer electronics industries on DVD technology diffusion for over two years. **Intel and the Software Publishers Association hosted a DVD Developer Conference on October 29**, providing development guidelines, tools and solutions to bring more compatible DVD interactive titles to PCs. The conference was a success with over 220 attendees from a

variety of industries hearing presentations from Intel, the SPA and others involved in DVD technology development. Also provided was a product showcase, a DVD developers case study, and product compatibility testing with 20+ software/content developers. Daikin* announced the first Intel Architecture-based Windows NT* DVD authoring tool as an important step in bringing low-cost authoring to a larger customer base. And two important new white papers were provided by Intel and the SPA to enable compatible DVD interactive title development in support of MCI and DirectShow*:

- **MCI recommended command set** for DVD title development under Windows* 95
- **DVD interactivity white paper** showing transition of MCI commands to DirectShow

To view some of the presentations given at the DVD Developer Conference, please visit the **SPA web site** (<http://www.spa.org/dvd/oct.htm>).

Intel also hosted the first **Intel Developer Forum (IDF) on September 29**, providing a day-long training track for OEMs and IHVs on implementing host-based DVD playback on Pentium II processor-based PC platforms. PC and peripheral developers from around the world received detailed presentations and tools, as well as direct access to Intel's top PC DVD architects. For an overview of the IDF DVD training track, please visit the **IDF web site** (http://developer.intel.com/intel/idf/abstract/host_dvd.htm). DVD white papers were also provided and are now available for download at the top of this page.

Next Steps:

- **PC OEMs** - Download the new DVD white papers from the DVD Developers Conference and the Intel Developer Forum and become familiar with DVD implementation. Begin to include DVD hardware in your PC designs and start preparing for host-based DVD in your platform designs for 1998.
- **Software Developers** - Download the new DVD white papers provided at the DVD Developers Conference and the Intel Developer Forum to ease development of compatible interactive titles for the PC. Start porting multi-CD titles to DVD-ROM. More importantly, begin developing new titles that incorporate full-motion video, high-quality audio, images and 3D graphics. Visit Intel's DVD Authoring Studio for assistance with getting your title on DVD.
- **Studios** - Continue the transition to the DVD format. Expand the collection of titles on DVD.

For More Information:

Understand DVD's role as a key ingredient of the **PC 98 System Design Guide** (<http://developer.intel.com/design/PC98/index.htm>).

Intel's DVD Authoring Studio in Hillsboro, Oregon, provides independent software vendors with access to a state-of-the-art DVD authoring facility that allows them to do software layout, testing and pre-mastering of DVD content (http://developer.intel.com/drg/hybrid_author/DEVLAB.HTM).

The **DVD FAQ** is a good source of more detailed information about DVD (<http://www.videodiscovery.com/vdyweb/dvd/dvdfaq.html>).

One stop shopping for DVD information on the web (<http://www.unik.no/%7Erobert/hifi/dvd/>).

Software Publishers Association information on DVD-ROM (<http://www.spa.org/dvd/default.htm>).

MPEG Organization DVD Resources (<http://www.mpeg.org/~tristan/MPEG/dvd.html>).

DVD and Microsoft* O/S web site (<http://www.microsoft.com/hwdev/devdes/dvdwp.htm>). Stay tuned to this Platform Solutions DVD technology page for the latest news about DVD on the PC platform.

Audio Technology

What's New:

- Read this month's Top Story, **Design High-Quality Audio at Lower Cost** with Audio Codec '97 Version 2.0, by Intel's Audio Marketing Manager, Russ Hampsten (<http://developer.intel.com/solutions/issue/stories/top4.htm>)
- Intel Announces **version 2.0 of Audio Codec '97** (AC '97) specification (<http://developer.intel.com/pc-supp/platform/ac97/>)
- **Audio 98 Roadmap** Available for Download (<http://developer.intel.com/pc-supp/platform/aud98/audio98.htm>)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

Increasing processor performance, integration of functionality and external expansion buses are among the major trends currently transforming PC audio. As processor performance increases, more functionality is accomplished in software. This is an industry-wide trend and can be observed across all platforms and CPUs. Hardware faces competition with software-only implementations and needs to demonstrate a functionality, performance or quality advantage. However, for high-performance 3D computing and gaming platforms, hardware acceleration will continue to be desirable. As the attach rate for a function goes up there is more incentive for integration onto the system motherboard or even into the Super-I/O or chip set logic. This is also an observable industry trend. External expansion buses offer PC OEMs system design and configuration flexibility, and offer PC customers user-friendly upgrades. The gradual replacement of ISA add-in cards with **USB** (<http://developer.intel.com/solutions/tech/usb.htm>) is under way, and **IEEE 1394** (<http://developer.intel.com/solutions/tech/1394.htm>) is also expected to gain momentum within the next couple of years. The transition to external digital audio is expected to be gradual because initial implementations will probably appear first at the mid- to high-end PCs and cost more than highly integrated motherboard audio solutions. Intel is providing the industry with recommendations and supporting data on hardware vs. software partitioning. Intel is very involved in each of these areas and the **Audio '98 roadmap document** (<http://developer.intel.com/pc-supp/platform/aud98/audio98.htm>) helps clarify the transitions and what the industry is doing for 1998.

Benefits to Users:

The main benefit to users is that they will get much higher quality audio solutions with several key new features that have not been possible before. 3D positional audio will bring new levels of realism to games with sounds being positioned interactively around the user, making them truly part of the 3D virtual experience. The user will also get much better music reproduction with MIDI utilizing Wavetable synthesis.

Benefits to Manufacturers:

Audio has become a very important and highly visible part of today's PC experience. With the arrival of very high quality built-in audio components and external digital connectivity, the quality of the PC audio experience will rapidly become a function of the PC customer's budget for audio peripherals. The growing diversity of PC audio requirements, platform segments, and buses forces all industry players to acknowledge that there is more than one right way to implement audio. Upcoming operating system releases are expected to fully support external digital audio peripherals and emerging digital consumer electronics connections, increasing system flexibility and scalability on the high end. By 1998, Intel expects digital extensions to the baseline system audio will emerge based on USB and IEEE 1394 specifications: USB for PC audio peripherals, and IEEE 1394 for connections to digital CE. AC '97, USB, and 1394 should be viewed as overlapping yet complementary specifications that provide OEMs with more opportunities to address a wider range of platform implementations. Intel expects that the majority of PCs in 2H98 will support analog connectivity. But in the end, it is the PC OEM who is in the best

position to determine whether a SoundBlaster* compatible, Digital-Ready, or Digital-Only audio solution satisfies the customer's needs.

Industry Status:

Intel worked with the industry to develop the original AC '97 specification in 1996. Many new audio products are now shipping that support AC '97. PCI (AC '97) audio products will be shipping in volume in the first half of 1998 time frame. With the introduction of Windows* 98 and WDM audio, USB audio devices will be enabled and shipping. The audio quality that AC '97 provides is a key enabler of **DVD** (<http://developer.intel.com/solutions/tech/dvd.htm>) content, as well as software-driven three dimensional audio technologies such as Intel's recently announced Realistic 3D Sound Experience (RSX) technology. Based on extensive feedback from leading industry audio chip and peripheral vendors, and PC manufacturers, the Audio '98 roadmap highlights the technical ingredients to deliver audiophile-quality audio to the PC.

At the Intel Developer Forum (IDF) in September Intel released a version 2.0 update to the Audio Codec '97 specification. The new spec is intended to augment the existing AC '97 version 1.03 specification rather than replace it. AC '97 rev. 2.0 defines new extensions supporting high-quality audio (like that from DVD), and extensions for modem and docking to help both desktop and mobile manufacturers adopt these features more quickly and cost-effectively. The specification can be downloaded from the Intel developer **AC '97 web site** (<http://developer.intel.com/pc-supp/platform/ac97/>).

At IDF Intel also discussed the implications of audio implementations with the PC 98 System Design Guide. IDF presentations from Intel's top architects for the PC 98 training tracks are available on **Intel's PC 98 web site** (<http://developer.intel.com/design/pc98/#IDF>).

Next Steps:

OEMs and IHVs: The time has come to start moving away from Legacy ISA audio to new PCI/AC '97 audio for the new features that it will only be able to deliver. All 1H'98 products should support AC '97.

E-mail Audio97@intel.com to add your name to the Audio '97 mailing list to receive periodic updates.

Come back to the Audio technology *Platform Solutions* news page for future information on AC '97 and Audio 98.

Don't miss the next Intel Developer Forum in February. Register at the **IDF web site** (<http://developer.intel.com/design/idf/>) before January 16 and save \$200.

For More Information:

For more background information (white papers and specifications) go to **Intel's AC '97 web site** (<http://developer.intel.com/pc-supp/platform/ac97/>).

For technical presentations on audio and other PC 98 training tracks from the September '97 Intel Developer forum visit the **PC 98 site** at (<http://developer.intel.com/design/pc98/#IDF>).

For more information on the **Audio '98 Roadmap** go to (<http://developer.intel.com/pc-supp/platform/aud98/index.htm>).

For more information on USB Audio, download the **USB Audio Application Note** (<http://www.intel.com/design/usb/applnots/292206.htm>).

USB Technology

What's New:

- New "External Interconnect Technologies" technical track to discuss USB and 1394 implementation at the **February Intel Developer Forum**. Register now and save \$200.
(<http://developer.intel.com/design/idf>)
- Intel Launches **USB Hub Monitor Solution**, New 8x931 Single-chip Controllers
(<http://www.intel.com/design/usb/8x931a.htm>)
- **Q&A with Intel's USB experts** in Issue 1 of *Platform Solutions*
(<http://developer.intel.com/solutions/archive/issue1/stories/USB.htm>)
- New **USB Products Arriving on the Market**
(http://developer.intel.com/design/usb/new_pcs.htm)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

Universal Serial Bus (USB) is the easier to use and flexible interconnect specification that enables instant "outside the box" Plug and Play peripheral connectivity. It allows users to add peripheral devices without expensive add-in cards or configuration headaches such as DIP switches and IRQ settings. A single connector type simplifies connection of all USB-compliant devices, including telephony peripherals, video phones, digital cameras, scanners and monitors in addition to joysticks, keyboards and other I/O peripherals. USB's hot attach/detach capability lets users add and remove devices without turning off their PC. USB also distributes power to peripheral devices and employs a hub architecture that allows as many as 127 different devices to be connected simultaneously.

USB is a key enabling technology for emerging PC initiatives including PC Imaging and Computer Telephony Integration (CTI). Moreover, the connectivity needed **to support Intel's Visual Computing Initiative** (<http://developer.intel.com/solutions/archive/issue1/focus.htm>) may now be attained without the need for add-in card solutions.

For more details, visit **Intel's USB home page** (<http://www.intel.com/design/usb/>).

Benefits to Users:

USB expands the PC experience by enabling a new dimension of configuration freedom and interactivity. The absence of add-in cards and power supplies also helps reduce overall system cost. USB is easier to use and allows users to instantly reconfigure their systems "on the fly" by plugging and unplugging devices. Because USB enables both isochronous and asynchronous data transfers, it has the capacity to enrich the user's ability to control peripherals, such as audio speakers, from the PC. The ease of device sharing makes PCs more manageable for users of home and business PCs.

Benefits to Manufacturers:

USB is an open, royalty-free specification which has received broad industry acceptance. USB's ease of use and relatively low cost are expected to support the continued expansion of the PC peripherals market into new and fast-growing areas such as digital imaging, integrated telephony and interactive multi-player games. Absence of add-in cards and, in many cases, external power supplies also simplifies product design and helps reduce costs. Fast time-to-market development solutions are available now from Intel and other suppliers.

Industry Status:

USB technology is in full-swing implementation. Most new PCs introduced in 1997 are shipping with live USB ports, ready to connect to USB-compliant devices. Many USB devices are now arriving on the market, and hundreds of USB peripheral products are slated for release in 1997 and 1998.

Intel has just announced the new single-chip 8x931Hx Universal Serial Bus (USB) hub controller and the new 8x931Ax USB hubless controller to complement the Intel family of integrated USB products. Hub monitors play a central role in implementing the virtually unlimited peripheral connectivity potential of USB. Intel expects the demand for "smart" USB hub monitors on Windows* 95 platforms to grow as users experience the benefits of USB. Intel is helping developers prepare with a comprehensive one-stop solution that includes a Win32 Driver Model monitor driver, USB Monitor class and Human Interface Device (HID) class-compliant APIs, an On-Screen Display (OSD) applet, Intel 8x931 and 8x930 USB hub controllers and HID-compliant firmware, Intel 8x931 and 8x930 USB hub reference board hardware schematics and application notes.

Intel also offers assistance for developers in the areas of systems integration and validation testing through its Peripheral Integration Laboratories and Systems Integration and Validation (SIV) program.

The next **USB Compliance Workshop** is scheduled for January 12 - 14 in El Segundo, CA. For event and registration details visit the USB Implementers Forum web site (<http://www.usb.org/developers/index.shtml>)

The **Intel Developer Forum in February** will have a technical track titled "External Interconnect Technologies" which will provide an update to USB with emphasis on understanding system compliance to the proposed USB specification update version 1.1. Learnings from USB applied to 1394 implementation will also be discussed. Register before January 16 and save \$200 off the registration cost. (<http://developer.intel.com/design/idf>)

Next Steps:

Peripheral Developers—Once they get their hands on USB, PC users may never let go. Now is the time to develop USB-compliant products, so you will be ready to meet this growing level of consumer awareness. Register for the Intel Developer Forum - External Interconnect Technologies track before January 16.

System Developers—Designing with PCIs that support USB and the OEM release of Windows* 95 will help position you to meet the anticipated consumer demand for "device-ready" USB-compliant PCs. Be sure to visit Intel's USB home page and the USB Implementers Forum home page for the design information, developer support and product information you need. Register for the Intel Developer Forum - External Interconnect Technologies track before January 16.

For More Information:

Q&A with Intel's USB experts, Steve Whalley and Bala Cadambi, in Issue 1 of *Platform Solutions* (<http://developer.intel.com/solutions/archive/issue1/stories/USB.htm>).

See Intel's USB home page for the **latest developer resources and design tools** (<http://www.intel.com/design/usb/>).

Visit the USB Implementers Forum home page for information **on development support, products and events** (<http://www.usb.org>).

1394 Technology

What's New:

- Revision 1.0 of the **1394 Open Host Controller Interface (OHCI) specification** was released to the industry. You can download it today.
(<ftp://www.austin.ibm.com/pub/chrptech/1394ohci/>).
- Intel delivers **keynote at the October 1394 Trade Association meeting** in Phoenix, Arizona. Jim Pappas, Director of Technology Initiatives at Intel, outlined the role 1394 will play in the future of the PC. **Download the presentation at.**
(<http://developer.intel.com/solutions/tech/1394.htm>)
- Presentations given at the 1394 Trade Association Developers Conference in San Jose, California in July show Intel's commitment to 1394. Download them here.
(<http://developer.intel.com/solutions/tech/1394.htm>)
 - * Intel presents its **commitment to 1394**
 - * Intel describes its proposal for **digital content protection over 1394**
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

IEEE 1394 is a video-speed serial interconnect that is now an IEEE standard. Like USB, 1394 enables plug-and-play peripheral connectivity, provides power to peripherals helping to eliminate each one having its own power supply, and supports isochronous data transfers. 1394, however, takes these capabilities to video speeds. USB and 1394 serve different needs which will coexist for the foreseeable future. Peripherals that do not require the high data transfer rates possible with 1394 will remain with USB. Eventually, PCs will need only USB and 1394 serial ports to handle all I/O, dramatically simplifying life for PC users.

The consumer electronics industry is already shipping digital camcorders, digital satellite receivers and digital VCRs all with 1394 interfaces. 1394 is the physical bridge that makes the convergence of consumer electronics and PCs possible. Existing products support 1394 protocols at 100 and 200 Mbps, with 400 Mbps products shipping in 1998. The 1394 road map extends to speeds at 800, 1600 and 3200 Mbps.

1394 also provides the storage industry with a PC interconnect to follow on IDE and the printer industry to replace the parallel port. Because 1394 can handle very high data rates, it encourages peripherals to transmit more "raw" data to the PC for host-based processing, which can significantly reduce the cost of some peripherals like digital still cameras. 1394 is important not only for connectivity to new digital consumer electronics devices, but also for core PC peripherals as they move to higher data rates. A 1394 scanner, for example, would be appreciably faster than a parallel port scanner, especially at higher resolutions.

In conjunction with USB, 1394 makes possible new "modular" approaches to PC architecture with the modules tied together with two serial buses. The proposed **Device Bay Specification** (<http://www.device-bay.org/>) is an excellent example of the great new applications enabled by 1394 (and USB), in this case providing peripheral modularity.

Benefits to Users:

One promise of 1394 is a significantly enriched PC user experience. Users will be able to use their PCs to control consumer electronics and PC peripherals, edit audio/video content, link peripherals to the Internet, and much more. 1394 will bring the PC to the family room to provide entertainment, gaming, and learning experiences not possible today.

Modular PCs will allow users to buy as little or as much PC as they like and to upgrade their PCs selectively, at will and painlessly. A PC system becomes more like a component stereo system, with 1394 playing the role of a digital RCA connector. 1394 could permit corporate information technology departments direct control over all users' peripherals for remote service and policy enforcement.

Benefits to Manufacturers:

Because it is plug-and-play, 1394 confers all the same benefits as USB to manufacturers in terms of ease-of-use and reduced customer support requirements. The user never needs to open the box. Because 1394 enables users ready access to rich digital content, it will make the PC more attractive, thereby driving revenues. The modularity offered by 1394 (in conjunction with USB) offers PC manufacturers a greatly simplified manufacturing process and lower inventories in both the factory and in the field. Peripheral manufacturers benefit from compliance to a single industry standard supported by both the consumer electronics and computer industries, allowing in many cases the same SKU to be sold into both markets.

Industry Status:

IEEE 1394.1995 is in production today in consumer electronics equipment. An enhancement, called P1394a, is expected to go to the IEEE for balloting by January 1998, though many manufacturers are already incorporating features from P1394a in their silicon. In November 1997, Rev. 1.0 of the **Open Host Controller Interface (OHCI) specification** was released to the industry. You can download this from the internet at (<ftp://www.austin.ibm.com/pub/chrptech/1394ohci/>). The industry is actively working on closing the definition of P1394b, which will define 1394 at speeds of 800 Mbps and beyond. Intel expects some 1394-enabled PCs to be available by the end of 1997 and processor chip sets supporting the 1394 Open Host Controller Interface to be available in 1998.

The transfer of copy-protected digital content, particularly video, over 1394 and other buses is a pressing issue for the movie and recording industries. Intel has developed a proposal, in conjunction with partners, for content protection and device authentication that is currently being evaluated by the Digital Transmission Discussion Group. You can download an overview of that proposal at the top of this page.

Next Steps:

PC system vendors and peripheral manufacturers: make plans now to support 1394 ports on your future systems if you haven't already. Conform as much as you can to the proposed P1394a specification. Also, use S400 speeds in new products to minimize the usage your device makes on the 1394 buses' bandwidth. Everyone, including consumer electronics manufacturers: ensure your 1394 interfaces are defined in compliance with the IEEE specifications and 1394 Trade Association guidelines to ensure interoperability.

Register for the **February Intel Developer Forum - External Interconnect Technologies track** before January 16 and save \$200. Intel's top architects will discuss USB and 1394 implementation techniques. Visit the **IDF web site** for all the details today (<http://developer.intel.com/design/idf>).

For More Information:

Contact the **1394 Trade Association** site for more information on 1394 and links to many other 1394-related sites (<http://www.1394ta.org>).

Instantly Available PC Technology

What's New:

- Intel power management architect Gary Solomon describes how the **new 3.3Vaux ECR** provides the industry's **first standard approach** to supporting power-managed PCI device wakeup for easy implementation in the Instantly Available PC
(<http://developer.intel.com/solutions/issue/stories/top4.htm>)
- **Updated**; Version 1.1 of the **Instantly Available PC Power Management Design Guide**
(<http://developer.intel.com/design/power/pcpower.htm>)
- New PCI SIG Steering Committee approved **3.3Vaux ECR for PCI-PM**, developed to enhance the base PCI 2.1 specification for device wakeup, is **now available for download**
(<http://developer.intel.com/design/power/pcipower.htm>)
- See the latest updates to the Instantly Available PC **Power Delivery Requirements and Recommendations revision 0.9** (a.k.a Power Supply '98)
(<http://developer.intel.com/design/power/supply98.htm>)
- Intel Announces the **Mobile Power Guidelines Version 1.0** targeted at special considerations for achieving ultimate power efficiency in Mobile PCs.
(<http://developer.intel.com/design/mobile/intelpower/>)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

The Instantly Available PC is a new way of viewing power management requirements for today's fully featured home or office desktop PC. The goal of the Instantly Available PC is to have a high-performance, feature-rich PC that is power efficient when active and idle, always connected even when "off," and "instantly available" to users whenever needed. The Instantly Available PC is made up of several industry standard ingredients:

- ACPI (Advance Configuration and Power Interface) provides a standard yet flexible interface between hardware and applications to communicate their power management capabilities to the operating system.
- PCI-PM (PCI Power Management) allows add-in cards to participate in the overall power management scheme and introduce a new methodology to the scheme as well.
- A dual mode power delivery system as described by the Instantly Available PC Power Delivery Requirements and Recommendations. This power delivery system will provide clean and intelligent power under both heavy and light loads.
- An ACPI enabled OS will combine the above ingredients to create an intelligent power management platform.

Benefits To Users:

Because of the Instantly Available PC, home users will experience a PC that behaves much like a consumer electronics device. When it is not active, it appears to be off—there is no noise, no heat and very low power consumption, but it's ready in an instant. With the ability to be connected to external consumer electronic devices via **USB** (<http://developer.intel.com/solutions/tech/usb.htm>) and **1394** (<http://developer.intel.com/solutions/tech/1394.htm>) ports, the Instantly Available PC will be the hub of the entertainment center. For example, when you insert your DVD movie, your PC would wake itself up and send the decoded video and audio signals to your ACPI compliant TV and amplifiers after it woke

them up too. The Instantly Available PC will deliver a whole new level of usability and robustness, giving us new capabilities for the PC platform touching multiple aspects of everyday life.

For the office PC, the Instantly Available PC has additional benefits with the ability to resume on a LAN event. Intel's **Wired for Management initiative** (<http://developer.intel.com/solutions/tech/wfm.htm>) specifies remote wake-up policies and procedures to help IT lower the TCO (Total Cost of Ownership). These can be implemented with the Instantly Available PC. No longer will IT managers have to worry about a PC being turned off and unable to get a software update packet at night. Energy savings due to power management are apparent, but your cooling cost throughout the entire campus will be lowered too.

Benefits To Manufacturers:

The Instantly Available PC combines an industry set of standard power management specifications that peripheral vendors and PC OEMs can develop products around. This ensures that all products will correctly work with each other and will be able to fully take advantage of the system power management scheme. By adhering to industry-established standards for power management, PC OEMs and peripheral vendors will not have to bear any additional R&D cost associated with developing an Instantly Available system or peripherals. By broadening the PC platform's capabilities we open the door up for different products that we can connect to the PC and enhance the users' experience.

Industry Status:

Intel, Toshiba*, Microsoft* and many other PC manufacturers are working on bringing ACPI platforms and peripherals to the PC community by the end of 1997. Microsoft has announced that its next versions of Windows* 95 and Windows NT* will be fully ACPI compatible. Most PC and peripheral manufacturers should provide full ACPI implementations by the third quarter of 1998. PCI-PM is now available from the PCI industry special interest group and with the addition of the 3.3Vaux ECR to the PCI-PM specification, vendors now have a standard way of supporting PCI device wakeup.

On September 29, 1997, Intel hosted a full day Power Management technology training track at the Intel Developer Forum. Attendees received one-on-one access to Intel architects, a complete collateral package of specifications, tools, and design guides necessary to implement an Instantly Available PC. Look for the next **Intel Developer Forum** in February 1998 (<http://developer.intel.com/design/idf>) for the best training on implementing the hottest technologies driving the PC platform today. Register at the **IDF web site** prior to January 16 and save \$200.

Intel also recently announced the Mobile Power Initiative targeted at achieving power efficiency for Mobile PCs in the 1999 timeframe. Not only has Intel recently announced the Pentium® processor with MMX™ technology at 233MHz to increase performance by 40% and decrease power usage by 50%, it has introduced the Mobile Power Initiative to focus on System Hardware, System Software, and Application Software. The new **Mobile Power Guidelines** (Version 1.0) are now available for download (<http://developer.intel.com/design/mobile/intelpower/>).

Next Steps:

Peripheral Developers and OEMs should become familiar with the key ingredients for the Instantly Available PC. Download and understand the specifications for each. Available now for download at (<http://www.teleport.com/~acpi>) is the **specification for ACPI**, and the **PCI-PM specification** is available at (<http://www.pcisig.com/pm10.pdf>). All the other necessary specifications for implementing an Instantly Available PC can be downloaded at Intel's **PM spec site** (<http://developer.intel.com/ial/powermgm/specs.htm>).

For Mobile PCs, you should become familiar with the Mobile Power Initiative and Mobile Power Guidelines to start designing for ultimate power efficiency in your next designs.

Register for the Intel Developer Forum - Wired for Management Baseline Specification track - to get the latest information on Instantly Available PC implementation. Register before January 16, at the **IDF web site** (<http://developer.intel.com/design/idf>), to save \$200 on the registration price.

For More Information:

The **Instantly Available PC Power Management Design Guide** for desktop platforms
(<http://developer.intel.com/design/power/pcpower.htm>)

Get the latest Instantly Available PC **Power Delivery Requirements and Recommendations** (a.k.a. Power Supply '98)
(<http://developer.intel.com/design/power/supply98.htm>)

Intel power management architect **Gary Solomon describes the ins and outs** of the Instantly Available PC in a Top Story from Issue #2 of Platform Solutions
(<http://developer.intel.com/solutions/archive/issue2/stories/top2.htm>)

For a **closer look at ACPI** (<http://www.teleport.com/~acpi>)

The **Mobile Power Initiative and Mobile Power Guidelines** designed to increase power efficiency in Mobile PCs (<http://developer.intel.com/design/mobile/intelpower/>)

PC 98 Technology

What's New:

- **Latest Updates to PC 98 System Design Guide will be posted here every month!**

***PC 98 Correction-Chapter 15, item #20**, "Video input or capture device supports capture of NTSC/PAL picture quality": Video decoders must be capable of decoding 4:3 aspect-ratio, 720x480/720x576 resolution at 30/25 fps at 16 bpp. Decoding of YUV4:2:2 data format is also required.

- Download the complete **PC 98 System Design Guide 1.0** or view it online Now!
Co-authored by Intel Corporation and Microsoft Corporation*
(<http://developer.intel.com/design/pc98/index.htm> or <http://microsoft.com/hwdev/pc98.htm>)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

The PC 98 System Design Guide describes and recommends how a range of PC platforms should be designed to enhance user experience and satisfaction. PC 98 covers mobile PCs, business and consumer PCs, entertainment PCs and workstations that will ship from mid-1998 through 1999. Hand-held devices running Windows CE* and servers are not included in the PC 98 document.

(For information on Server design, check out the new **Hardware Design Guide for Windows NT***

Server just announced by Intel and Microsoft

(<http://www.intel.com/pressroom/archive/releases/SP110497.HTM>).

The PC 98 System Design Guide is divided into four parts. Part 1 covers upcoming technologies that will be available in the 1998 and 1999 timeframes. Part 2 contains a rigorous description of System Types—most of this section describes a Basic PC 98 from which a Business, Consumer or SOHO (Small Office Home Office) desktop can be derived; two styles of Entertainment PCs, a two-foot viewing experience and a 10-foot viewing experience are described. Mobile design considerations are covered in a separate chapter, as are Workstation design issues. Part 3 describes expansion bus options such as USB, IEEE 1394, PCI, SCSI and other industry specifications. Part 4 details how add-in and add-on devices should be designed; many new technologies and specifications are introduced in this section.

Benefits to Users:

PC 98 describes the introduction of new technologies into PC designs that are becoming more tailored for specific uses in the business and consumer markets. These new technologies and platform designs are intended to increase the utility and ease of use of the PC for different kinds of tasks and offer more choices to businesses and consumers. The overall goal of PC 98 is to address the expanding uses and users of PC technology, and to enhance the user experience and satisfaction.

By writing this document together, Intel and Microsoft are ensuring that the enabling hardware and supporting software will be available at the same time. The lead-time for new hardware designs and for software device drivers is being overlapped to shorten the time to a working, available solution. This up-front cooperation and planning will result in a better user experience.

Benefits to Manufacturers:

Introducing multiple new technologies into the existing PC platform infrastructure could create numerous problems. By working together and with industry experts, Intel and Microsoft have identified a variety of solutions and are creating new industry specifications, or supporting existing industry specifications, to ease rapid and successful absorption of these new technologies. By driving open specifications, Intel can also encourage innovation throughout the multiple PC platform design choices.

Industry Status:

Intel has been a behind-the-scenes contributor on previous versions of the PC 98 design guide. Due to the many projects Intel has on-going to introduce new hardware technologies and increase ease-of-use and end-user satisfaction of PC hardware, Intel's involvement in PC 98 has been growing. It was a natural fit to have Intel co-author with Microsoft on PC 98. Intel and Microsoft have both worked with the industry since February 1997 to review and improve the PC 98 System Design Guide in order to reach a releasable version.

Version 1.0 of the **PC 98 System Design Guide** was released to the industry in September 1997 and is now available for download from Intel's and Microsoft's web sites at

<http://developer.intel.com/design/pc98/index.htm> or <http://microsoft.com/hwdev/pc98.htm>.

Real time updates to the design guide will be posted in the "What's New" section at the top of this page every month.

On October 1, 1997 at the Intel Developer Forum, Intel hosted a full day technical training for hardware developers on PC 98 implementation. Intel's top architects spoke about three key implications for PC 98 hardware implementation: removal of the ISA Bus, Audio, and Graphics. Microsoft joined Intel at IDF to speak on Driver Quality. To view all of the PC 98 IDF presentations, please visit **Intel's PC 98 web site** (<http://developer.intel.com/design/pc98/#IDF>).

Next Steps:

If you are currently designing PCs or peripherals for shipment after June 1998 and throughout 1999, the PC 98 System Design Guide is a "must-have" reference. It contains definitive information on the evolution of the PC platform, together with essential information for developers. Visit Intel's PC 98 web site for your copy today.

Stay tuned to *Platform Solutions* and the **IDF web site** (<http://developer.intel.com/design/idf>) for information on the **next Intel Developer Forum coming in February 1998**. Register prior to January 16 and receive \$200 off your registration price.

For More Information:

Intel's developer web site also contains detailed design information on all aspects of PC design (<http://developer.intel.com>).

Read an overview of three key technology implications of PC 98 in "**PC 98: Keeping the PC Platform Balanced,**" by John Hyde, Intel's PC 98 Architect and Design Guide Editor in Issue #2 of *Platform Solutions* (<http://developer.intel.com/solutions/archive/issue2/stories/top5.htm>).

Read an overview of PC 98 and Intel's role in "**Leading the Way to PC 98,**" by Jim Pappas, Director of Platform Initiatives at Intel from Issue #1 of *Platform Solutions* (<http://developer.intel.com/solutions/archive/issue1/stories/pc98.htm>).

See the other "Platforms" and "Technologies" pages of *Platform Solutions* for the latest news and information on PC technologies found in PC 98 (<http://developer.intel.com/solutions/>).

For information on server platform design, check out the **new Hardware Design Guide for Windows NT* Server** announced by Intel and Microsoft (<http://www.intel.com/pressroom/archive/releases/SP110497.HTM>).

Platform Performance Tuning Technology

What's New:

- Matt Gordon, Intel IHV Ingredient Marketing Manager, fully describes Intel's **new platform performance tuning tools** in *Platform Solutions*—Issue 2 (<http://developer.intel.com/solutions/archive/issue2/stories/top3.htm>)
- **New Intel Performance Evaluation and Analysis Kit (IPEAK)** web site available (<http://developer.intel.com/design/ipeak/>)
- Industry Status (see below)
- Next Steps (see below)

Technology Description:

One of the principal barriers historically confronting PC OEMs and IHVs has been a general lack of performance tuning tools designed to accelerate their hardware development efforts. For the most part, development tools for performance optimization and design analysis are typically developed internally by OEMs and IHVs themselves. In order to accelerate new platform technology adoption and optimize platform performance, Intel is sharing the results of its R&D efforts and making available a new line of development tools, previously used internally by Intel engineers and architects, to the broad PC industry.

At the last Intel Developer Forum (IDF) on September 29, Intel announced the new family of performance evaluation and analysis tools called the Intel Performance Evaluation and Analysis Kit (IPEAK) to be available in Q1 1998. IPEAK tools help ease technology adoption and platform performance tuning for PC OEMs and Independent Hardware Vendors (IHVs). As the first offerings of their kind in the industry, the IPEAK tools help shorten product time-to-market cycles when adopting new platform technologies and standards. The tools also provide automated testing solutions that reduce the time spent on testing during the system validation process.

The new IPEAK offerings include the IPEAK Power Management Toolkit, the IPEAK Storage Toolkit and the IPEAK Graphics Toolkit:

- **IPEAK Power Management Toolkit** consists of one tool—the *Power Management Analysis Tool (PMAT)*—developed to help PC OEMs and IHVs incorporate the Advanced Configuration and Power Interface (ACPI) power management initiative into their product design and system integration processes. It also helps to qualify power management functionality, quantify power consumption and test the behavior of applications that incorporate Global System Power Management functionality.
- **IPEAK Storage Toolkit** consists of four tools—*RankDisk*, *AnalyzeDisk*, *Win32 Tracking Kit*, and *AnalyzeTrace*—developed to help vendors identify optimal storage performance at low cost in product designs. In addition, these tools help PC OEMs and IHVs to select the best possible performance storage products at the same price point.
- **IPEAK Graphics Toolkit** includes two tools. The *Graphics Performance Toolkit* provides a better understanding of the performance issues and limitations related to graphics hardware and applications. And the *Baseline AGP System Evaluation Suite (BASE)* is a system integration and validation tool that provides the capability to test and evaluate **AGP** system-level functionality and utilization (<http://developer.intel.com/solutions/tech/agp.htm>).

Benefits to Manufacturers:

The new IPEAK toolkits make it easier for OEMs and IHVs to understand performance issues and limitations that can be addressed in the design process to optimize product performance. For example, IHVs can use these tools to detect any performance pitfalls and make corrections while in the pre-production stage, thus lowering the risk of accruing additional costs and delays in their product shipment schedules.

Benefits to Users:

In addition to the benefits they provide for manufacturers, the IPEAK toolkits will help Information Technology (IT) managers to evaluate and select products with increased performance when engaged in system integration activities, or when making decisions related to hardware configuration. Equally significant, the tools benefit users by ensuring that the PCs they purchase have been configured in ways that optimize their performance, functionality and reliability. End- users will be able to fully realize the performance capabilities of new processors, including the Pentium® II processor, combined with new platform technologies.

Industry Status:

In the past, performance and evaluation tools, such as those found in the IPEAK toolkits, have not been generally available. With the introduction of the IPEAK tools at the Intel Developer Forum (IDF), Intel has become the first company to provide these specific kinds of platform performance tuning and integration tools for PC OEMs and IHVs. Intel is currently conducting a beta program for the IPEAK tools. PC OEMs, IHVs, and ISVs are welcome to join the program. IPEAK tools are expected to be available in first quarter of 1998.

Next Steps:

Intel will be monitoring feedback on the IPEAK tools from users who are part of the beta program. PC OEMs and IHVs can get up to speed on the new IPEAK offerings by accessing information available on the new IPEAK web site, and by continuing to check the status posted on this news page in *Platform Solutions* every month.

If you would like to be considered for the IPEAK beta program and receive pre-release versions of the tools, please send an email to ipeak@intel.com.

Register before January 16 for the **February Intel Developer Forum - IPEAK Storage Tool track** and save \$200. Visit the **IDF web site** (<http://developer.intel.com/design/idf>) for all the details.

For More Information:

For more details on the IPEAK tools, including screen shots, please check out the **IPEAK web site** (<http://developer.intel.com/design/ipeak/>).

Read the Top Story, **"Introducing Intel Platform Performance Tools,"** by Matt Gordon—Intel IHV Ingredient Marketing Manager—in Issue 2 of *Platform Solutions* (<http://developer.intel.com/solutions/archive/issue2/stories/top3.htm>).

For more information on Power Management technologies, please visit the **Instantly Available PC** technology page in *Platform Solutions* (<http://developer.intel.com/solutions/tech/power.htm>).

For more information on Accelerated Graphics Port (AGP) technology, please visit the **AGP technology page** in *Platform Solutions* (<http://developer.intel.com/solutions/tech/agp.htm>).

Industry Events:

Consumer Electronics Show '98

January 8-11, Las Vegas, NV, USA

Intel will be on hand at the LVCC venue, booth S102, to demonstrate how the latest Pentium® II processor PCs are having an impact on consumer electronics and being used throughout the home, as well as outside the home, in many new ways. One example demonstration will be Intel's Connected Car PC technology which takes the proven Intel Architecture PC platform to the automobile. Another is Intel's new Set-Top Computer design used in the family room for internet access, telephony, and interactive digital television broadcasting. For more details, please visit the **CES web site** (<http://www.cesweb.org/>)

USB Compliance Workshop

January 12-14, El Segundo, CA, USA

The USB Implementers Forum will hold it's first compliance workshop of 1998 at the Embassy Suites, LAX South, in El Segundo. The event is free to USB Implementers Forum members who have USB supported PC systems, peripherals, tools, etc. ready for compliance testing. The goal of this event is to provide private testing in order to guarantee USB product interoperability.

For more details and registration, please visit the **USB I/F web site** (<http://www.usb.org/developers/index.shtml>)

1394 TA Work Group Quarterly Meeting

January 26-29, San Francisco Airport, CA, USA

This is a quarterly meeting of the 1394 TA organization working group. This meeting will be hosted by Sun Microsystems* and held at the Hyatt Burlingame Airport in San Francisco.

For more details on the agenda, please visit the **1394 TA web site** (<http://www.1394ta.org/upevents/upevents.html#jan27>)

Smart Battery System I/F Developers Conference & Interoperability Workshop

February 2-4, Kauai, Hawaii, USA

The event is being held in Hawaii to make it more convenient for Japanese and other Asian professionals to attend. The conference will give system designers and battery manufacturers the opportunity to talk to the top technical experts for SBS, ACPI and SMBus. Speakers, from both the industry and the press, will conduct starter and advanced tutorials on SBS architecture, the SMBus protocol, operating system support via ACPI, SBS as a component of PC 98, hand-held device issues, addressing and more. Safety issues and guidelines will also be covered. Discussions as to the future of the specification will be open to all participants. The Interoperability Workshop ("Plugfest VI") will be held at the same time.

For more information and registration, please visit the **SBS I/F web site** (<http://www.sbs-forum.org/marcom/devcon.htm>)

Accelerated Graphics Port (AGP) Plugfest

February 10-13, Milpitas, CA, USA

The AGP Plugfest is for manufacturers of AGP-enabled motherboards, systems, graphics controllers and add-in cards to test interoperability. Testing is done in a private, one-on-one, nondisclosure environment without competitive pressure. In addition to the typical functional tests, including electrical, BIOS, and platform interoperability, there is also thermal testing and training. This event is for members of the AGP Implementers Forum only.

For more details and registration, please visit the **AGP I/F web site** (<http://www.agpforum.org/>)

Intel Developer Forum

February 17-19, San Jose, CA, USA

**** EARLY-BIRD Registration Ends JANUARY 16 --- save \$200 ****

Go "*Beyond the Spec*" at this second bi-annual hardware developer event hosted by Intel, at the San Jose Convention Center. The Intel Developer Forum (IDF) is the industry's premier event for hardware developers. Get implementation tools, detailed training and knowledge, directly from Intel's chief technology architects, on the latest technologies driving the hardware platform. IDF covers today's implementation details and tomorrow's technology roadmaps, to help speed the development of new products integrating the current advancements in desktop, mobile, workstation and server platform technologies. In addition, IDF provides a valuable opportunity to establish and strengthen personal working relationships with technology leaders from throughout the PC industry, and from around the world.

For more details on the IDF technical tracks and registration, please visit the **IDF web site** (<http://developer.intel.com/design/idf>)

Intel Developer Forum DVD Plugfest

Late February, San Francisco Bay Area, CA, USA

This by "invitation only" event will involve interoperability testing of various components of DVD playback for personal computers. Vendors of DVD drives, graphics cards, MPEG hard and soft decoders, OEMs of personal computers, and software content providers will convene to test their products for compatibility over a 3 day period. Stay tuned to Platform Solutions for more information on this event in the future.

CeBIT

March 18-25, Hannover, Germany

Europe's premier computer, telecommunications, and Information Technology industry fair. For more details, please visit the **CeBIT web site** (http://www.messe.de/cb98/index_e.html)

WinHEC

March 25-27, Orlando, FL, USA

Windows* Hardware Engineering Conference to be held at the Orange County Convention Center. PC industry event for manufacturers and suppliers of hardware products supporting Microsoft* Windows* family of operating systems. WinHEC brings together technical managers and product developers to examine new technologies for designing future Windows based computers.

For more details and registration information, please visit the **WinHEC web site** (<http://www.microsoft.com/hwdev/winhec.htm>)

Intel Networking Events & Training

For Intel's events and training programs on networking products and technologies, please visit the **Intel networking events page** (<http://www.intel.com/network/events/index.htm>)

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